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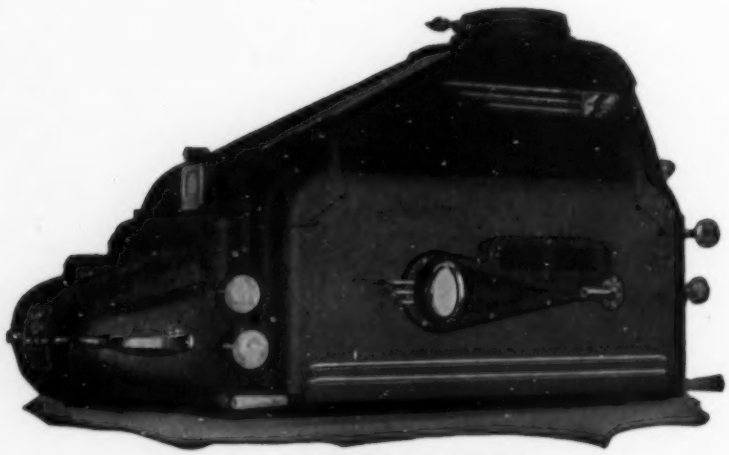

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INTERNATIONAL PROJECTIONIST

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Volume 30 **JULY 1955** **Number 7**

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Monthly Chat

WITHIN two months IP enters upon its 25th year of service in behalf of the art of projection generally and, more specifically, the projectionist craft. Many discussions have appeared in these columns which were provocative in the extreme, depending upon which side of the road one was traveling — manufacturer or practicing projectionist. IP is proud of the fact that never in its existence has it ever denied the full and free use of its columns to anybody who had anything interesting to say about the projection process.

The past two years have witnessed, perhaps, the most rugged expression of opposing viewpoints, due undoubtedly to the sudden switch of the industry to new production and exhibition processes. Practically every phase of visual and aural film production and projection — from negative film stock to cameras, through the distribution channels and especially relating to exchange practices, right down to screen reflectivity — all aspects have been worked over in these pages.

Through the years IP has not always been on the right side of these discussions, alas, but it has always tried to be accurate and has always permitted the widest possible latitude in the matter of expressions of opinion. This policy will continue, of course. We would wish that our readers were a bit more vocal with respect to written expressions relative to IP's content, but we are consoled by the knowledge that we have only to make a slight "bull" (and we've made them) to induce a flock of mail. This is good for the craft and for IP, and we shall always encourage the practice.

AT a recent gab-fest among three manufacturers of projection equipment and several knowledgeable projectionists, two of whom with approximately 40 years' experience in the craft and who are responsible for projection in scores of theatres, the talk inevitably turned to the inescapable topic — how present practice results in our "burning up the film." It was agreed, of course, that in pouring on the light we produce heat. But, it was pointed out that *we* asked for more powerful carbons, bigger lamphouses, bigger mirrors, faster lenses, and bigger pictures, and now that *we* have what we asked for it is up to *us* to do something about it. But that *something* should be that or those things which are reached by mutual agreement and concerted action.

One participant in the discussion said "Sure, the heat embossed the film and caused buckle, making good focus very difficult, but this was only half the story." His notion was that the damage to the film was done after only one or two runs, not by extended playing time. Thus, he continued, his idea was that the manner in which the film *enters* the gate and its positioning while in the gate, a strictly *mechanical* problem of precise tension, was of extreme importance, film embossing or no.

Sad it is that such meetings could not include 50 manufacturers and projectionists. It could happen, and IP will never stop trying. But, apparently, the writers of complaining letters to IP prefer to fight the battle at long range.

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INTERNATIONAL PROJECTIONIST

VOLUME XXX JULY 1955 NUMBER 7

Projection Lens Terminology

"F:1 Light-Collecting Speed," F Numbers, and T Stops

By Dr. K. PESTRECOV

Research Professor of Physics, Boston University

AS a lens designer and an optical consultant, the writer has been following closely the recent developments of projection optics and has participated in some of them. It is gratifying to note that due to the efforts of many manufacturers and their willingness to assume very heavy research and engineering expenses, the projectionist has now a wide selection of projection optics which are better corrected and deliver more light to the screen than those available just a few years ago.

In view of this outstanding record —and considering the fact that new products can be readily promoted on the basis of their factual merits—it is regrettable that a lens maker has now decided[1] to designate a series of new lenses as having an "*F*:1 light-collecting speed." This designation has no scientific significance until it is *rigorously defined* and generally accepted as valid and not contradicting established standards.

The premise for the aforementioned announcement is that "due to the limited technical knowledge of the public" the designation of lenses by *f*-numbers has been greatly misinterpreted. This argument is basically fallacious because the general public cannot be expected to understand every technical term. On the other hand, those active in a certain field of science or engineering, and its application, are required to exercise sufficient mental effort to become familiar with the technical terms generally accepted in the field of their professional interest.

Many Diverse Designations

The problem of designating lens speed is as old as lenses themselves, and a comprehensive review thereof is not within the scope of this article. Suffice it to note that since the middle of the last century, when photographic and projection lenses acquired a most important place in modern technology, many systems of stops (or of speed rating) were proposed, used, and abandoned.

Among these were: the aperture-number system (frequently used by German manufacturers); the Paris Congress (1899) system; the uniform-stop system (Royal Photographic Society, 1881); the system of intensity numbers (Carl Zeiss); the Stolze (Goerz) system, and several others which used *arbitrary* numbers to designate the speed of lenses. Throughout the world, practically all these systems have finally yielded to the *f*-number system, which uses the basic physical and mathematical relationships determining the illuminance in the *focal plane* of a lens, and which is a measure of the *nominal axial* "speed" of a lens.

The words "nominal" and "axial" are emphasized because, as is properly stated in the aforementioned announcement[1] the *f*-number does not take into account the light losses in the system and its vignetting characteristics. Thus, if one lens of a given *f*-number has relatively small light losses and covers a given format without substantial vignetting, its *effective* speed may prove to be much higher than that of another lens of the same *f*-number and covering the same format, but having substantially *greater* light losses and vignetting.

This situation was particularly disturbing when the optics were not coated to prevent reflection losses, and when optical designers were readily sacrificing the off-axial illuminance in order to achieve a better over-all correction of aberrations.

The 'T-Stop' Concept

The shortcoming of *f*-numbers has been remedied somewhat by the concept of the *T*-stop, which has been introduced and generally accepted[2,3] after an extensive and thorough study of all the pertinent factors by experts in the field of theoretical and applied optics. The *T*-stop designation takes into account the light losses, and it is a *true* measure of the axial speed of a lens. Allowing for the unavoidable minor tolerances for measuring errors and numerical designation, all lenses of the same *T*-number have the same axial optical speed.

The *T*-number still does not take

into account the vignetting characteristics of lenses. There is no other rigorous method of expressing these characteristics, except by presenting a curve of the *relative* illuminance within the intended field of coverage. If, however, one wants to obtain a measure of the "effective" *T*-number (or speed) of the lens within its *entire* field of coverage, he may by the process of integration or summation and averaging compute the integrated or average "area weighted" *T*-number.

'Average' Evaluation Insufficient

Some manufacturers actually use such an evaluation for their own technical purposes, and isolated attempts have also been made to designate lenses by such "average" *T*-numbers instead of *f*-numbers or axil *T*-numbers. These attempts have not met with a favorable reaction, because the critical user interested in the vignetting characteristics of a lens cannot determine them from the average *T*-number and he still needs the relative illuminance curve for their determination. Furthermore, if only the "average" *T*-number is given, the user loses even the important basic information as to the *actual* speed of the lens in a part of the field near the axis.

It seems that the proposed designation of "light-collecting speed" necessarily involves a concept similar to the "average" *T*-stop. Therefore, the same objections should be voiced to the "light-collecting speed" designation as to the "average" *T*-number designation. Neither of them indicate the *actual* axial speed of the lens and its vignetting characteristics.

New Terminology Needless

Another even much stronger objection is to the selection of the symbol "*F*:1" for rating the "light-collecting speed" of the new lens. Since it is hardly possible that the actual axial speed of the new lens is as high as *T*—1.0, and that on top of that it has practically no vignetting losses, it seems evident that an entirely *arbitrary* basis has been used for the "*F*:1" rating. No technical justification can be presented for using an arbitrary basis, particularly considering the extensive and costly efforts of manufacturers, of government agencies, and of others to effect standardization of optical terminology, practices, and equipment.

It would be a pity if the remarkable progress, achieved by such organizations (just to mention a few) as the American Standards Association, the U. S. Air Force, the Optical Society of America, the American Society of Photogrammetry, and the Society of Motion Picture and Television Engineers in the field of national and international standardization, be hampered or reversed by the introduction of new concepts, the need for which does not exist and the meaning of which is obscure.

A manufacturer may think that the use of a designation which implies an unusually high speed for a lens would have a definite promotional value. Even this value is extremely questionable because other manufacturers may follow the lead, and, with equal lack of justification, use "better" designation such as "*S*:0.8" or "*T*/0.4", or what not.

It is hoped that this will not be the case, because technological and commercial advantages cannot be permanently secured by terminological chaos, and the user will ultimately revolt against it.

It is quite possible that the announcement discussed herein actually described a lens *T*—1.0 or faster, which covers the motion picture frame with insignificant vignetting. If this should be so, the author would be thrilled to know about such a lens, and then he would withdraw all his objections except one:

That the existing standard concepts and terminology are entirely adequate for establishing the *f*-number, the *T*-stop (axial or average) or even a properly defined "light-collecting speed" of any lens that can be conceivably designed.

---

[1] **New Hilux Lens Series by Projection Optics. International Projectionist, Vol. 30, No. 6, p. 23; June 1955.**

[2] **Military Standard: "Photographic Lenses." MIL-STD-150, 23 October, 1950.**

[3] **American Standard. "Aperture Calibration of Motion Picture Lenses." ASA PH22. 90-1953.**

More Optics Data

SPHERICAL ABERRATION: In an uncorrected objective lens system, the rays from the center of the object which pass near the edge of the lens are bent more sharply than those passing near the center of the lens, and in consequence are brought to focus at a point nearer the lens itself. If the center of the object is a bright point of light, its image appears as a similar point, but surrounded with a blurred circle.

COMA: This is similar to spherical aberration, but of a non-symmetrical character affecting images of points not at the center of the object. The blur of each image point in this case is not a circle, but a tail like a comet (hence the name) extending toward or away from the center of the image.

ASTIGMATISM: Astigmatism, like coma, affects only the images of points off the optical axis. It is the tendency to image the object point as two short lines, mutually perpendicular and longitudinally displaced from each other. Between these two lines lies an "image," or blur pattern of minimum size.

CURVATURE OF FIELD: In the simple case, curvature of field occurs when a *flat* object is imaged on a *curved* surface, usually concave with respect to the lens. Sometimes this aberration can be overcome by curving the object itself, as in the case of the curved slit used in sound reproduction, or the curved surface of a television tube. Curvature of field is usually accompanied by astigmatic differences.

DISTORTION: Distortion occurs when the magnification of the system is not *uniform* across the entire image. If regions near the edge of the object are magnified more than those near the center, "cushion" distortion is present, so called from the appearance of the image of a square or rectangle. If the reverse is true, the phenomenon is called "barrel" distortion.

Optical systems generally suffer, to a greater or lesser extent, from all these aberrations in combination, plus color aberration in the case of white-light illumination. The problem of the optical designer is to reduce them to a minimum, and how well he has succeeded is evident in the really excellent lenses available today to the motion picture theatre field.

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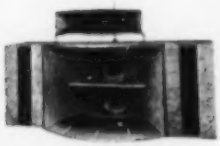

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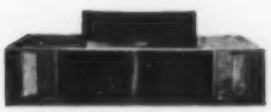
TYPE PL-303A—Speaker System



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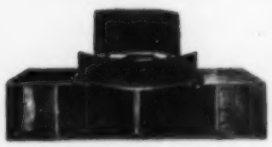

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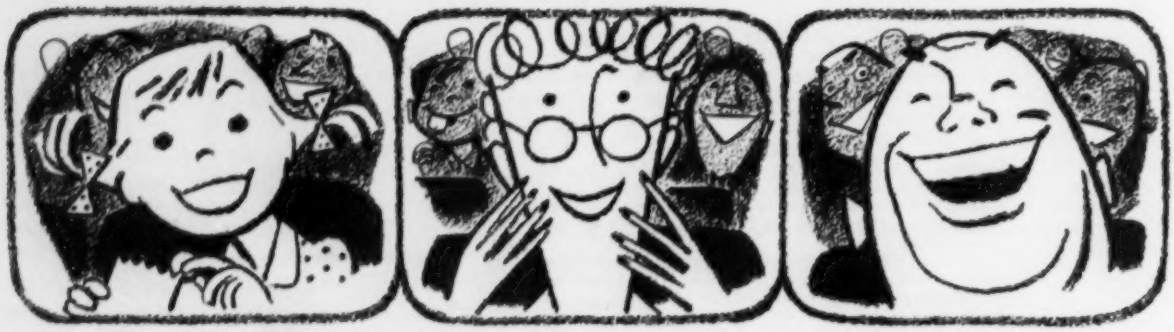

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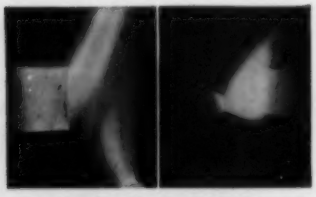

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Prevention of Damage to Prints

By ROBERT A. MITCHELL

II. Conservation Measures in the Projection Room

NO ATTEMPT should be made to clean full-length rolls of film in the projection room. Prints that are oily and dirty cannot be cleaned effectively and without injury except by the use of film-cleaning machines. Very few theatres possess machines of this kind; and merely wiping the film with a dry cloth at the rewind bench does nothing but redistribute the oil and scratch the emulsion with gritty particles collected on the cloth.

The cleaning of prints is the responsibility of the film exchange. The job is best done by apparatus having plush-faced scrubbing wheels which gently buff both sides of the film as it passes through a small tank of film-cleaning fluid such as carbon tetrachloride. The film is thus scrubbed and rinsed at the same time; and the liquid is discarded and replaced with fresh fluid as soon as it becomes dirty.

Short rolls of film may be cleaned in the projection room by drawing the film slowly through a folded soft cotton cloth moistened with film-cleaning fluid. There are a number of suitable fluids. Carbon tetrachloride is probably the best, particularly for CinemaScope magnetic-track prints. A half-and-half mixture of carbon tet and gasoline is also good.

The cotton pad must be kept moist with the fluid at all times, and the surface changed frequently to avoid accumulations of dirt which might abrade the emulsion. The film must be rewound very slowly to permit complete evaporation of the fluid which, if wound into the roll, might spot the film.

Carbon-Tet's Lethal Properties

The treacherously poisonous nature of carbon tetrachloride must be guarded against when cleaning film. Carbon tet can kill! Headache and nausea are a first warning of carbon tetrachloride poisoning. Prolonged breathing of the fumes, or continued absorption of the liquid through the skin, may result in fatal illness.

Film cleaning should therefore be done in a well-ventilated room, preferably by an open window. Special precautions should also be taken when using gasoline or cleaning naphtha. The vapor of gasoline is heavier than air and tends to sink down to the floor where it mixes with air to form a highly explosive mixture in unventilated rooms. Besides doing a better job, film-cleaning machines decrease the risk of poisoning and explosions.

Brand-new, or "green," prints fresh from the processing laboratory pose a special problem on account of their tendency to "stick" in the heated gate of the projector during the first few showings.

The emulsion of fresh film is comparatively moist and much softer than that of old, seasoned film. The heat of the gate melts the emulsion along the perforation margins of a green print, and some of the softened emulsion collects on the surfaces of the steel runners, especially in the vicinity of the aperture. Here the gelatine, gummy and sticky at first, is baked to bone-hard deposits which interfere with the movement of the film and are difficult to remove. These deposits must be scraped off after each reel. For this purpose a piece of copper or brass must be used. Never use steel, which scratches the polished runners. Scratched runners aggravate sticking and abrade the emulsion of new prints.

A sticking print passes through the projector gate with a loud chattering noise. The film alternately holds too tightly, straining or even tearing the perforations, and "overshooting," or slipping down until stopped by contact of the upper edges of the perforations with the intermittent-sprocket teeth.

Overshooting gives a projected picture that jumps violently. Examination of the print after projection reveals deep abrasion along the line of perforations even when the perforations themselves have escaped mutilation. The abrasion is caused by contact of the perforation margins with emulsion deposits on the gate runners.

Sticking may be minimized by reducing pad tension over the aperture, while overshooting can be prevented by drastically increasing pad tension. This should never be done as it ruins the print. Users of certain European projectors can utilize the velvet-covered film runners provided for this purpose. Velvet runners are the best safeguard against the sticking of new, unwaxed prints. Why these have never been supplied for American projectors is a mystery.

Only adequate lubrication of the perforation margins of the film prior to projection can wholly prevent sticking in projectors not supplied with either velvet runners or water-cooled gates. As an emergency measure during projection, many projectionists apply a small quantity of machine oil to the perforation margins as the film feeds into the mechanism. The oil is best applied with two fingers in order that both margins may receive lubrication at the same time on the emulsion side of the film. To alternate the application of oil from one margin to the other will cause side-weaving of the picture.

The exchanges do not like to have projectionists oil the film because the oil eventually works into the picture area where it spots the film and collects dirt. From the projectionist's standpoint, the oil vaporizes in the hot gate and condenses as an oily fog upon the rear element of the lens, spoiling the clearness and contrast of the picture. But there is no doubt whatever that sticking is more harmful to new prints than a little oil.

New prints are usually waxed by the

"Runoff," as illustrated, is a common type of film damage that occurs when the film jumps a sprocket because of a stiff splice or some other reason. Long lengths of film are often damaged when the "needled" sprocket teeth cut holes in the soundtrack and picture.

processing laboratory before sending the rolls to the exchange where they are assembled and mounted on shipping reels. The waxing machines apply a thin coat of carnauba wax to the perforation margins on the emulsion side of the film. A few laboratories use substitute waxes. Some employ the more expensive process of lacquering the entire emulsion surface with a microscopically-thin film of plastic.

Waxed prints do not always run satisfactorily. A deficiency of wax permits sticking to occur; too much wax melts off and collects on the runners, tension pads, and sprockets. The use of plastic lacquer is also open to objection. It curls the film and makes it more likely to fracture when sharply bent.

Oiling 'Green' Prints

The writer recommends a somewhat different method of oiling "green" prints in the projection room. Lay the reel down on the bench and wipe the exposed sides of the roll with a small cloth pad lightly impregnated with medium-heavy machine oil. The pad should be moved to follow the curvature of the film convolutions. When one side of the roll has been oiled, the reel should be turned over and the other side oiled. Enough oil gets onto the perforation margins to prevent sticking, and there is little danger of messing up the picture and soundtrack areas.

Only green prints that have never been projected should be lubricated. Never oil a print known to have been used in another theatre unless it sticks during the first run.

In place of the cloth containing oil, silicon-impregnated cleaning cloths may be used for lubricating the edges *(only the edges!)* of green prints. Slight dampening of the silicone cloth is necessary to release the silicone oils, but excessive application of water should be avoided.

The lubricating effect of silicones is less permanent than that of ordinary hydrocarbon oil, for oil quickly dissolves and removes silicones from the film. However, by the time the silicones have been removed by contact with traces of oil on the gate runners, pads, and sprockets, the print will probably be "broken-in" sufficiently to run without the need of extra lubrication.

Silicones Not Recommended

The commercial silicon-treated cloths sold for cleaning film should *never* be used for this purpose. Not only is there an ever-present danger of scratching the emulsion by gritty particles adhering to the cloth, but an oily streak or mottle may be left on the film if too much silicone lubricant be applied, or the cloth be excessively dampened. Moreover, a smear of silicon oil on the film increases the pickup of dust from the air.

A number of laboratories which have used liquid silicone solutions for cleaning prints have reported trouble in the way of streakiness, smearing, and mottling. Experience with processed negatives cleaned with silicones indicates that materials of this type transferred to positive raw stock during contact printing produces photographic fog.

Even though the manufacturers of silicone cloths urge the use of their product for cleaning many articles found in projection rooms, we must strongly warn all readers against cleaning lenses with these cloths. A film of silicone oil on a projection lens results in a loss of focus and contrast and interferes with the optical functioning of the anti-reflection coatings. Also avoid cleaning shellac phonograph records with silicone-impregnated cloths. The silicones penetrate the shellac and cause physical deterioration of the delicate surface, thus accelerating record wear.

Rewinding Hints

Films ordinarily arrive at theatres wound on the shipping reels "head first." As previously explained, the film is inspected during the first rewinding, preferably on a hand-driven rewinder. This prevents the cinching and pleating which may occur when rapid motor-driven rewinders are stopped suddenly at frequent intervals by grasping the revolving reels.

The sudden arresting of a rapidly-turning reel allows the outer layers of a heavy roll of film on the driver element to keep on turning by sheer force of momentum. Since successive turns of oily film have a strong tendency to "lock", rather than slip, kinks and S-bends may be formed in the roll. Film which is pleated, or folded back upon itself, in the reel, usually tears and breaks in the projector. Any kinks present in a reel of film must be removed by winding it again at low speed.

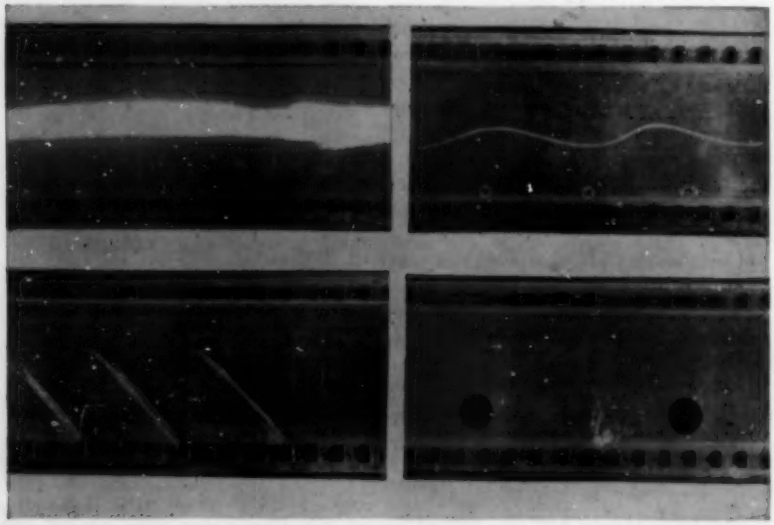
The film in the roll on the "dummy" element is severely strained by tightening, or cinching, when the revolving reels are suddenly arrested. The film may then become defaced by short lengthwise scratches—cinch marks.

The reel of film which has just been inspected and repaired is normally in "tail-first" order, and must be rewound for showing. The final rewinding may be done on the motor-driven rewinder.

Adjustment of Rewinder

This rewinder, which is also used for normal rewinding during the show, should be aligned and adjusted so that the film winds evenly, with a moderate

(Continued on page 28)



Four samples of unsightly changeover cue marks sometimes found at the end of reels. This type of damage is not nearly as common as it was some years ago, and is generally found on old prints that have seen a great deal of use in many theatres over a long period.

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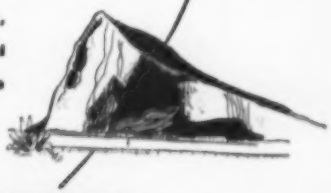

Motiograph projectors have a reputation of lasting practically forever. Hundreds of the popular Model F, produced over 30 years ago, are still in use today.

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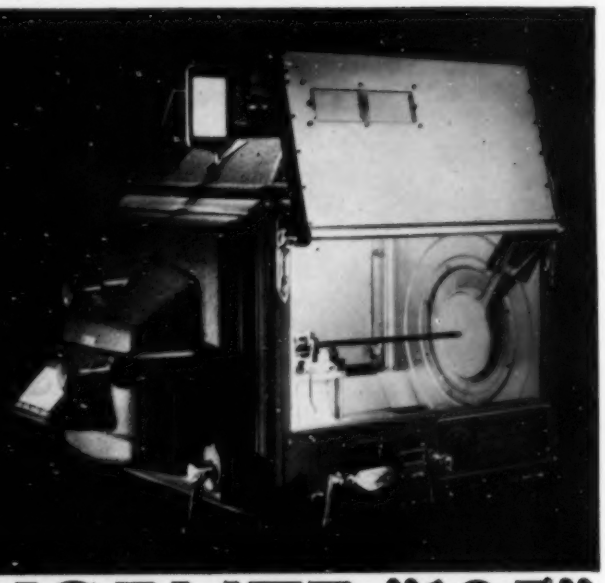

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- The arc is stabilized by a stream of air which maintains a prescribed system of ventilation of the area surrounding the arc. This air jet prevents the hot tail flame of the arc from reaching the reflector, supplies enough oxygen so that no black soot is produced, and keeps white soot from collecting on the reflector in such quantity as to absorb heat which would cause breakage.
- Unit construction permits easy removal of elements for inspection in servicing.

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A 'Push-Pull' Projector?

By J. G. JACKSON

Member, IA Local 348, Vancouver, B. C., Canada

IN standard (?) projection the rotating shutter cuts off and wastes approximately one-half the available light. holes, or two standard frames, at each In push-pull projection this waste light is utilized by directing it through a second aperture and to the screen.

Figure 1 is a side view showing the principle involved. Two standard film gates with apertures and lenses are arranged one above the other, and each has its own intermittent sprocket of 32 teeth. The film path is down through the top gate and intermittent sprocket and into a loop. From this loop it feeds down through the lower gate and its intermittent sprocket and into the second loop.

As the sprockets have 32 teeth, they each move the film a distance 8 sprocket pull-down. The intermittent cams are timed at 180 degrees and revolve at only 720 r.p.m., or one-half standard speed. Cams and stars are of standard Geneva design.

'Continuous' Projected Light

While the film in aperture 1 is being exposed to the light beam, the film in aperture 2 is on the move to the next frame, and *vice versa*. In this way a continuous light can be projected to the screen, first from one aperture and then from the next. The optical axis of the two systems meet at the screen center so that the two images will be superimposed but of opposite timing.

In front of aperture 1 is a stationary mirror, *A*, set at 45 degrees to the optical axis and facing *downward*. In front of aperture 2 is also a stationary mirror, *B*, at 45 degrees to the optical axis and facing *upward*.

Midway between mirrors *A* and *B* is a third stationery mirror, *C*, also at 45 degrees to the optical axis and facing upward toward mirror *A*. The mirror *D* is also at 45 degrees to the optical axis and faces downward. This mirror is in the form of a rotary shutter with a single blade of 180 degrees. This shutter rotates at a speed of 720 r.p.m. to coincide with that of the intermittent cams.

Mirrors *A*, *B*, and *C*, are water-cooled to absorb the intense heat of the light beam. Rotating mirror *C* is cooled by its own air currents as it revolves.

Assuming, now, that the film is stationary in aperture 1, the rotary mirror or shutter will be open and the light beam will fall into mirror *C* and will be reflected to mirror *A* and through aperture 1 to the screen. During this time the film in aperture 2 will move to its next frame. The rotary shutter will then cut the light beam and reflect the light to mirror *B* and through aperture 2 to the screen. While aperture 2 is being exposed, the film in aperture 1 will move and be ready for projection when the rotary shutter again opens the light beam.

Projection Sequence Bars Errors

Figure 2 shows graphically the projection cycle with a continuous flow of light to the screen. The cutover from frame to frame takes place during the period when both intermittents are on the "lock", thus there can be no travel-ghost.

Figure 3 shows the 180-degree balanced mirror shutter. Fig. 4 shows the approximate arrangement of images on the film where the frames are staggered to the distance between apertures. Thus, aperture 1 projects the frames with *even* numbers, while aperture 2 projects the frames with *odd* numbers.

This arrangement produces push-pull projection with continuous light on the screen and with an efficiency rating of 100%, except for the slight reflection losses in the mirrors.

This projector would be very well suited for television since the continuous light on the screen eliminates most of the scanning problems involved in converting from 24 to 30 frames per second.

For Cinerama or other very large screen projection, the double frame Vista-Vision principle can be used. The projector is then horizontal and the sprockets will have 64 teeth so as to pull the film two double frames, or 16 sprocket holes, at a time. This is considerable film to pull, but since the intermittent cams turn at only 720 r.p.m., the film velocity is no greater than in the present Vista-Vision projector.

By the use of anamorphic lenses a large picture suitable for Cinerama may be obtained from a single film. Almost any aspect ratio can be had from the double-frame aperture. With the high efficiency of this projector, ample light can be projected through the double-frame aperture to illuminate such a screen. This eliminates the troublesome joining of images that is now encountered in triple-projector Cinerama. With this type of projector there is no need for intermissions, as a normal two-projector setup can be used.

Single-Film 3-D Projection

With slight modification, this projector can be used to project 3-D pictures from a single film, even on a large screen. Single-frame projection is used, since the intermittent cams turn at standard speed of 1440 r.p.m. and will be timed at 90 degrees apart. The sprockets have 32 teeth to move the

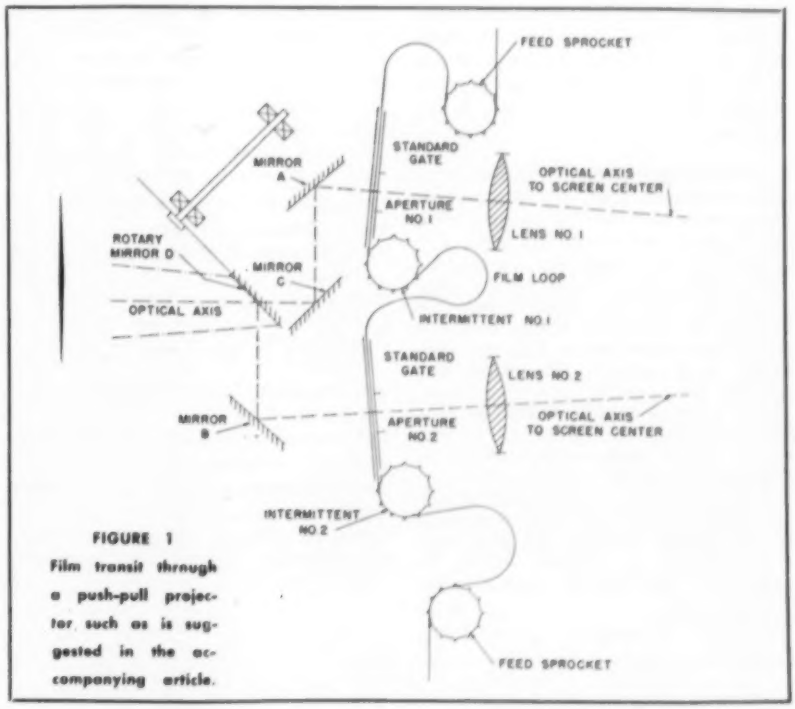


FIGURE 1
Film transit through a push-pull projector such as is suggested in the accompanying article.

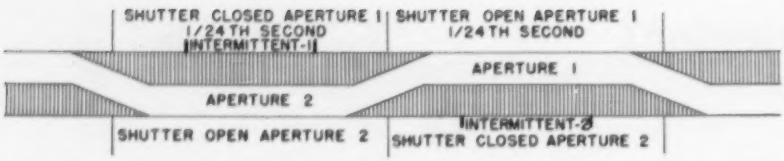


FIGURE 2

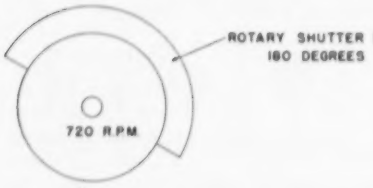
film two single frames at a time.

The rotating mirror shutter now turns at 2880 r.p.m. to give two exposures to each frame and 48 exposures per second to each aperture. One aperture exposes the right-eye images, while the other aperture exposes the left-eye images through the respective filters. Each image receives the same amount of light as is now obtained by the two-projector system.

Various Aspect Ratios Possible

Should the need arise for a screen with an aspect ratio of 3 or 4 to 1, it can be obtained by using the 3-D projector and anamorphic lenses. The optical axis of the two lenses would be seperated so that each lens covers only

FIGURE 3



one end of the screen, with the join of the two images in the centre of the screen. Thus the number 1 lens would cover the left half of the screen, while the lens number 2 would fill the right half of the screen. As each would project the standard 48 exposures per second, there would be no flicker problem.

EDITOR'S COMMENT: The concept of a push-pull projector for continuous projection is not a new one, but it has unfortunately been discarded by the trade for reasons of cost and mechanical and optical complications. The continuous projector devised by Dr. Emil Mechau of the Ernst Leitz Kinowerke, Rastatt, Germany, was probably the most successful from every point of view. When in good condition, the Mechau machine played standard 35-mm sound prints with remarkably lifelike results on the screen.

It is interesting to note that a pair of Mechau projectors are being used at the present time by the BBC television studios in London. Some 30 years ago the Mechau had a brief tryout at the Capitol Theatre in New York City.

Jackson's push-pull projector differs from the Mechau in that intermittent movements are employed and is optically simpler, thus reducing likelihood of misadjustment and breakdown. The complicated rotary mirror system of the Mechau militated against wide use of this projector in theatres. The Jackson machine, however, has the almost fatal disadvantage of requiring SPECIAL PRINTS which would be useless for ordinary projection.

There is no doubt that the Jackson projector would work splendidly and give smoothly-moving and flicker-free pictures at approximately twice the illumination-efficiency of the standard type of projector. It would also serve admirably in the special applications mentioned. But the industry is not prepared to accept a projector which needs a radically off-standard type of print.

If one were permitted to induce further thought by Mr. Jackson on this intriguing subject, it would be to urge him to exercise his undoubted talents in the direction of a continuous projector for standard film release prints (whatever they may be these days), not so much in terms of image width as in continuity of image projection.

Projector Archivist

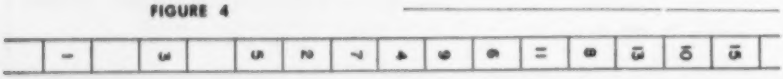
HERE is the second installment of data from the fabulous collection of projection memorablia amassed by Ray Brian (IA Local 434, Peoria, Illinois) in many, many years of dedicated research to the art and the craft he loves—motion picture projection. IP is indebted to Ray for making these data available, as should be the craft at large, many of whom have charted and are proceeding along a similar course.

Many of the projectors cited in the appended list are possessed physically by Ray, together with photos and detailed descriptions thereof. For many of the others, alas, Ray does not possess even a photo, and these are indicated in the following listing by an asterisk.

If there be anybody anywhere (and IP circulates world-wide) who can supply such data, he would be making a signal contribution to projection lore. Ray may be contacted through IP. Here is the second rundown:

BENBOW—made in Australia before 1920.*
BESSUS—made about 1900.
BURWOOD—made in Wilkes-Barre, Pa., about 1924.
BING—made in Germany, 1899 to 1914.
BIOGRAPH—American Mutoscope and Biograph Co., 1896: 70-mm, no perforations; later 35-mm.*
BIOGRAPHET—American Mutoscope and Biograph Co., 1902.
BIOKAM—made in England by Warwick Trading Co., 1898.
BIO-PICTURESCOPE—made by W. C. Hughes, London, England, 1914.
BIOPTICON—Latham's third machine, 1896.*
BIOSCOPE—Built by Walter Issac for Charles Urban, 1897.
BIOSKOP—Max Sklandowsky, Berlin, Germany, 1896.
BIRTAC—made by Birt Acres, London, England, 1898.*
BLAKE— . . . *
BRENKERT—Karl and Wayne Brenkert, 1940; now R.C.A.
BREWSTERGRAPH—W. C. Hughes, London, England, 1912.
BROCKLISS—J. Frank Brockliss, London, England, 1913.
CAMEOSCOPE—H. E. Roys, 1914.*
CAMERON—James A. Cameron, Brooklyn, N. Y., 1910.*
CELLO—Hale Projector Co., East Boston, Mass., about 1920.
CENTOGRAPH— . . . *
CENTRAL—made by Fuji Co., Japan, 1954.
CENTURY—Century Projector Co., since 1923.
CENTREX—Australian version of the Century.*
CENTAURO—made in South America, 1954.
CHARLIN—made in France, 1949.
CHRONIK—August and Louis Chronik, New York, N. Y., 1899.
CHRONOGRAPH—Georges Deameny, France, 1897.
CHRONOPHOTOGRAPHOSCOPE—about 1900.*
CHRONOSCOPE—Hanau and Gauthier, about 1900.*
CIEROSCOPE—Appleton, about 1900.*

FIGURE 4



Ampex Profits, Assets Up

Ampex Corp., Redwood City, Calif., completed its fiscal year April 30 in the strongest financial position in its history. Sales for the magnetic tape recorder manufacturer rose to $8,163,000 from the previous year's $5,418,000.

Profits for the past year showed a substantial increase and amounted to $762,621 before, and $365,736 after, taxes. These figures compare with $70,191 before taxes in the previous year, and $25,691 after taxes. Per share earnings after taxes for the year just ended climbed to 69 cents per share in contrast to six cents per share in 1954.

A Research Triumph: The Story of Black-and-White Film†

By C. E. KENNETH MEES

The second and final article of a series which details to the technically-minded, the thrilling story of the development of black-and-white film base.

NOW turn from the negative making material to the release-print positive, of which such very large amounts have always been used in the motion picture industry. The positive film has two characteristics in which it differs from the negative material. It must be of sufficiently fine grain to increase to the smallest possible degree the graininess inherent in the negative. It must also have a contrast which, when combined with that of the negative material, will give a satisfactory contrast in the projection print. The positive emulsion supplied as Eastman Cine Positive Film in 1916 met these requirements satisfactorily and remained unchanged for many years. When type numbers were introduced, it was assigned Type 1301.

Many attempts were made to produce a positive film having a lower graininess, but all failed because the film was too 'slow" for use on the standard printers and also tended to give a warm-toned image which was not generally satisfactory for projection. It was not until 1940 that Fine-Grain Release Positive Type 1302 was made having sufficient speed, provided that the printers were modified to increase the light available, and having definitely lower graininess than Type 1301 with an image of pleasing tone. Types 1301 and 1302, therefore, cover the whole history of motion-picture positive film up to date.

Colored Bases for Tints

About 1920 a demand arose for positive films on colored base, which enabled a tinted film to be obtained by simply printing upon film having the right color in the base. In 1921 positive films were available on lavender, red, green, blue, pink, light amber, yellow, orange and dark amber bases. When by 1929 sound films had displaced the silent films, difficulty arose with the tinted bases, because the dye absorbed the light used for exciting the photoelectric cells by which the sound record was reproduced.

A new range of tinted positive supports were therefore introduced under the name of Sonochrome. They were designed to provide satisfactory monochromatic scenes and, at the same time, enable the sound record to be utilized without difficulty in projection. After the fine-grain ciné positive was introduced in 1940, three of the Sonochrome tints were used for this new emulsion.

In 1926, J. G. Capstaff and M. W. Seymour published an important paper in the Transactions of the SMPE on the duplication of motion-picture negatives. At that time, prints made from duplicate negatives were notably inferior to direct prints. Duplicate negatives were usually made on Par Speed Negative material from projection positives and showed graininess, distorted tone scale and edge effects.

New Duplicating Film

A new duplicating film was made by the use of a fine-grained emulsion, the contrast of which was controlled by the addition of a water-soluble yellow dye. It gave little increase of graininess, good tone rendering and a minimum of edge effects, because development could be prolonged to eliminate the effects without producing too much contrast. At first, the same film, Type 1503, was used for both negative and positive.

In 1929 a duplicating positive, Type 1355, was introduced. Its speed was somewhat higher and its contrast somewhat lower than the standard release-print material of that date. In 1930 a fast, yellow-dyed negative material was coated as Type 1510. In 1933 a duplicating positive Type 1362 was introduced. In 1936 two new duplicating films were made having a finer grain than the regular positive of that date.

When the motion-picture trade adopted the reproduction of sound, interest arose in the use of special films for sound recording. There were two different methods of recording sound upon film: (1) that in which the density of the track was modulated, the variable-density method; and (2) that in which the width of the track was modified, the variable-width method.

In 1930 L. A. Jones and O. Sandvik published a discussion of the "Photographic Characteristics of Sound Recording Film" in the *Journal* of the SMPE. The variable-width recording method did not present a serious problem since release positive film gave very good results, but in 1928 a yellow-dyed, negative-type emulsion was introduced as Type 1507 for use in variable-density sound recording. Not until 1932, however, was a sound-recording film, Type 1359, supplied which gave results in variable-density sound recording sufficiently better than those obtained on motion-picture positive film for it to be generally adopted by the trade.

In 1936, Type 1357 was introduced for variable-area recording. Types 1357 and 1359 were very similar, and new films, Type 1372 for variable-area and Type 1373 for variable-density recording, were introduced at approximately the same time in 1944 and are still in use.

Films specially made for color photography are not dealt with here, but it should be mentioned that since 1916 many films have been made for use in current processes of color photography. The Technicolor Corp., for instance, has used special red-sensitive, green-sensitive and blue-sensitive negative films in its three-strip cameras. It has also used specially made matrix films and positive films on which the final image was built up by transfer printing. Many of these films have been made to the specifications of the Technicolor Corp., and their development is a part of the history of Technicolor.

Safety Base Films

Ever since 1909, efforts have been made to replace the highly inflammable cellulose nitrate base of motion picture films by a cellulose acetate

(Continued on page 27)

† Condensed from the "History of Professional Black-and-White Motion Picture Film," Journal of the SMPTE, Oct., 1954

Magnetic Recording, Reproduction

By L. D. GRIGNON

Development Engineer, 20th Century-Fox Film Corp., Hollywood

In line with its time-honored policy of providing space for anybody who has anything interesting to say about the process of motion picture projection, IP is privileged to present the appended article. Brickbats and bouquets will be our lot, we know; but this is the medium through which we reach the desired goal of technological exactitude.

IN your "Letters to the Editor," April 1955 issue (page 24) there appeared a reply to Mr. David Bliss concerning magnetic sound tracks. The first two paragraphs are precisely correct; but the paragraphs pertaining to magnetic recording and reproduction are seriously in error and should be corrected.

Sound for magnetic recording with CinemaScope is recorded and printed (actually a recording-transfer operation) with the high frequencies up to 8000 cycles per second faithfully reproduced and with slowly increasing attenuation of the frequencies above 8000 cycles per second. With optical sound systems, 8000 cycles per second must be suppressed by as much as 15 to 18 db in accordance with the Motion Picture Research Council recommendations.

The lack of surface noise is the result of magnetic recording methods, *not* frequency characteristic adjustments, and, as a matter of fact, it is possible to reproduce up to 8000 c.p.s. and higher with magnetic principally because of the lower noise from this medium and because of less distortion: the high notes are "cleaner" and less shrill and therefore not disturbing to the listener.

'Balanced' Reproduction Scale

There is another factor which contributes to the sound quality of CinemaScope magnetic tracks which is difficult to describe simply. The psychology of listening requires a balanced reproduction scale of frequency, by which is meant that if either end of the frequency range be extended, the other end must also be improved.

For example, if the treble (high) end is extended from 5000 to 8000 cycles per second, the bass (low) end must also be extended downward to 50 to 60 cycles per second—and both improvements must not add appreciable distortion. This is what is done in CinemaScope and is one reason for the better bass response. Similarly, any restriction of the frequency scale must be performed on *both* ends as with optical tracks.

It is the combination of magnetic recording, stereophonic methods, extended frequency range (both high and low ends) and lack of background noise which makes CinemaScope magnetic recordings superior to all previous motion picture sound methods.

You strongly criticize proponents of CinemaScope for being ". . . suspiciously aloof . . . from field evaluation" and ". . . for good reason, apparently". You will note on page 54 of the latest edition of the CinemaScope Handbook, "Information for the Theatres," a recommended theatre sound reproduction characteristic. If you will compare this with the standard Research Council Frequency Characteristic for optical sound, it will be again obvious that magnetic tracks reproduce much more faithfully than optical tracks.

Yes, But Can One Hear It?

Now, your last paragraph refers to little or no reproduction at 10,000 cycles per second. May I submit that if this were true, there would be no reproduction of any signals from the fourth track because the control signal, which must also be reproduced, is 12,000 cycles per second! The material in the Handbook, mostly obtained from theatre experience, shows that your criticism is unjustified.

We of Twentieth Century-Fox are intensely interested in field problems and have found the service companies cooperative and expending every effort to adjust theatres in accordance with recommendations by ourselves and the Research Council. We know this from frequent field trips.

If you have found theatres with poor speech intelligibility and no high-frequency response from magnetic (not optical-CinemaScope) it is most likely due to misadjustments, too little servicing, or too much "tinkering" in those theatres, because all five producers of CinemaScope in Hollywood using magnetic release tracks are doing a fine sound job.

EDITOR'S COMMENT: If practical considerations of sound reproduction in the average theatre be ignored, and only theoretical considerations and laboratory determinations taken into account, we could be in substantial agreement with the opinions expressed by Mr. Grignon. This point of view, however, would require us to forget the projectionist, who can do no more than attempt to produce a presentable picture and listenable sound from the print that is daily handed to him.

Differences of opinion anent C'Scope magnetic sound, in fact, have arisen *via* the inevitably inadequate procedures adopted by the average theatre and the average film exchange in regard to C'Scope magnetic sound. This type of sound is very different from standard optical sound, considered *as a process*, and it demands an entirely different point of view as regards the maintenance of equipment and the handling of prints.

On the basis of *regular* motion picture sound, C'Scope magnetic sound is incompatible in every sense of the word. Whoever thought of placing magnetic tracks on a *picture* film apparently knows little about the mechanics of *practical* projection.

Inherent Defects of System

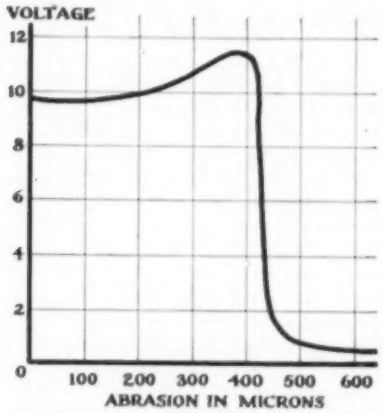
It is no secret that C'Scope magnetic tracks readily become attenuated through daily use in a wide variety of theatres, or that they pick up noise through the influence of stray magnetic fields or rapidly-moving steel and iron projector parts. It is no secret that the relative number of magnetic-track prints issued by 20th Century-Fox is far greater than the proportion of theatres fitted to play magnetic tracks of this type.

Furthermore, the 12,000-cycle control signal for the fourth track (used only by a small minority of theatres) hardly constitutes a serious indication of the high-frequency response appreciable by the ears of patrons

in the average house set up for C'Scope magnetic reproduction. Even the very fact that this particular frequency (12,000) was selected as a control is very revealing as to the high-frequency response expected of C'Scope magnetic reproduction.

Wide Cyclic Span

There is no apparent reason why 15,000 cycles should not be regarded as the practicable top-cut for C'Scope magnetic tracks *except for the accepted fact of magnetic-track deterioration in release prints.* With careful handling, and with the exclusive use of sound reproducers apart from picture projectors, different gap standards would permit reproduction up to and including 20,000 cycles with this type of track!



How reproduction of an 8,000-cycle track by a CinemaScope magnetic head decreases through wear. (A micron equals 39.37 millionths of an inch.) So rapid is the abrasion, that in much less than a year magnetic-track frequency response is inferior to that of regular optical-track sound. Sound quality deteriorates correspondingly, with "crumbly cough" distortion spoiling the sound.

There is no need to discuss attenuation at the highest frequencies if such frequencies come through to the ears of the listener, as every studio employs its own standards and exercises its own judgment in such a matter, limited only by the physical shortcomings of the system employed. This is why we find different standards applying to variable-area and to two separate systems of variable-density optical recording. With the advent of electro-optical crystal valves, a third set of standards will appear.

Formal Standards vs. Practice

We are not impressed with the attenuation standards advocated by *any* engineering body for the simple reason that no one pays any attention to them. (The standards mentioned by Mr. Grignon are applicable more to variable-density than to variable-area methods.)

We are acutely aware of the higher noise level of optical recording methods; but we are also aware of the stability of optical tracks and of the signal-to-noise ratio of optical recordings as a function of prevailing signal level, due to the characteristics of "noiseless" biasing of optical tracks. Magnetic recording is definitely superior to *all other types* of sound recording, but only so long as the records are handled with kid gloves, so to say.

There are other factors to be considered. Despite the introduction of new alloys for reproducing heads, which permit a C'Scope magnetic head to be used as long as a year without deterioration of sound quality, defects in the print tracks still remain. As far as the writer knows, Fox prints its magnetic tracks at high speed *via* passage of the master copy and the unmodulated print track through a high-frequency mag-

(Continued on page 26)

Do Our Ears Grow Old?

By H. C. MONTGOMERY

MEMBER OF THE TECHNICAL STAFF, BELL TELEPHONE LABORATORIES

Present day practitioners in the art of the recording and reproduction of sound waves talk and write glibly of frequencies of the order of 8-, 10-, and 12,000 cycles (while the pure idiots extend the range to 15,000). As a refresher for the informed, and as basic information for the unknowing, IP mischievously offers here excerpts from an article which it published 'way, 'way back in 1932. "Progress" will be the answer of the "moderns"—but this applies with double force to the life-span of a human and his constantly-diminishing aural acuity.

About 200 audiograms were available, mostly of Laboratories' employees ranging in age from 20 to 60 years. The subjects were selected in such a way that the proportion having defective hearing is about what might be found in any normal group of people. These audiograms were divided according to the age of the subject into four groups, each group including ten years.

The hearing of each age group was summarized by finding the median value of the hearing loss at each frequency. The median was used rather than the average because it is not so much affected by extreme cases.

2000 Cycles Vital Point

It is noteworthy that the difference between the thresholds of the youngest and oldest age groups is quite small compared with the difference between the normal and hard-of-hearing ears. In fact, at frequencies below 2,000 cycles the differences are negligible; but at frequencies above 2,000 cycles the differences become appreciable.

This decrease in average hearing ability with increasing age might be the result of either of two causes: a *considerable* impairment of the hearing of only a portion of the older group, or an impairment in the hearing of the *whole* group.

Reference to the original data indicates that the latter is the more nearly correct explanation, for the average deviation of the cases from the median is practically the same for all the age groups.

A question of practical interest is what effect the indicated change in hearing acuity will have on the ability to hear and understand in actual situations. The *upper* part of the frequency range, the only part sensibly affected, is of importance chiefly in distinguishing certain consonants and in appreciating the *timbre* or *quality* of musical sounds. In ordinary conversation, where speaker and listener are close to each other, no difficulty would be experienced by the 50-60 group, because the level of sound at the ear is high enough so that the falling-off at the high frequencies would not be noticed.

The theatre or lecture hall presents a different situation. Here the level of sound at the ear is often quite low. Moreover, the higher frequency components are usually relatively weak by the time they reach the ear, due to selective absorption . . . Under these circumstances, the 50-60 group might experience some difficulty in distinguishing consonant sounds, and mistake "thin" for "sin," "famish" for "vanish," and the like.

'Brilliance' Lacking

Music would probably sound somewhat different to members of the older group, but it is doubtful whether they would be aware of this difference because they would lack a standard of comparison. Melody and rhythm they would appreciate as well as anyone. But the tones would lack *brilliance*, and differences between the instruments would not seem so profund to them as to younger persons.

In The

SPOTLIGHT

The function of this department is to provide a forum for the exchange of news and views relative to individual and group activities by members of the organized projectionist craft and its affiliates. Contributions relative to technical and social phases of craft activity are invited.

ELSEWHERE in this issue is a compendium of questions and answers relative to Pay-As-You-See Tv, the plan of a few sponsors who *think* they have *invented* a process which will enable them to make billions of dollars through a scheme which will charge millions of people for an inherent civic right which the latter already possess.

The aforementioned compendium was prepared by, paid for and vigorously sponsored in many diverse ways by a group of motion picture theatre owners who promptly recognized the threat implicit in the Toll-Tv proposal. It will not be news to the readers of these columns that Organized Labor, and particularly the IATSE, have joined wholeheartedly in opposition to the plan.

The core of the arguments advanced by proponents of Toll-Tv is that they will give *something extra* beyond that which is now available through existing Tv facilities. Let it be said emphatically that this is the veriest nonsense: Toll-Tv proponents plan to give *nothing* but to *TAKE* for a restricted group of insiders! These guys tell everybody who hasn't sense enough to shut his ears that they will provide ***"extras"*** in the way of entertainment, educational and civic features, including warnings of an almost instantaneous attack by a foreign power, earthquakes, conflagrations in a given area, floods and every other conceivable catastrophe. The question is: "How?"

These guys also insinuate constantly that they will get "special" channel allocations so as not to interfere with the regularly scheduled Tv broadcasts now on the air for free.

Yea? Well, taking their word for it (which we don't) where are they going to get the transmitting facilities, no less than the receiving facilities for area distribution? What about transcontinental network transmission facilities? Shall we assume that they will accomplish this by osmosis?

These Toll-Tv people even had the temerity to announce last month that they had accomplished the feat of putting two signals on one channel—a story that hit the front pages of practically every major newspaper in this country and abroad (the dopes), while the ever-gullible trade press swallowed the potion without tasting it first. IP effectively debunked this silly nonsense in a terse statement of nine lines in its last (June) issue, p. 5. Nobody has yet challenged the statement, including its sponsor, Paramount Pictures.

Now, the sad part about this situation is that the general public, reading all this hooey, hasn't the vaguest notion of what is in the minds of these Toll-Tv guys. But it remains for a little guy like IP serving a small but select group of readers to tell the world, as follows:

These Toll-Tv sponsors plan to build *nothing*, either in the way of transmission, distribution or reception facilities. They plan to use *existing* transmitting facilities, *existing* distribution facilities, and *existing* reception facilities—the latter being YOUR Tv set. The only expenditure contemplated by these fellows, apart from an enormous publicity expenditure for the dissemination of "factual data" (?) among the unknowing general public and, especially, unknowing Congressmen, will be the decoding equipment, for which *you'll* pay, and punch-cards for YOUR Tv set. The word "existing" is not a mere notion with these fellows; it's a *disease* of planning and scheming.

There's not a single major motion picture producer who is not ardently in favor of Toll-Tv. Sure, he wants to sell existing motion picture theatres, existing Tv stations, and producers of commercial movies. Like any lawyer, he'll service any client—that is, any client with a ball pen.

Barney Balaban, president of Paramount Pictures, said a mouthful when replying to the published opinion of RCA Board Chairman David Sarnoff to the effect that Toll-Tv was unacceptable. Said Balaban: " . . . pay television is inevitable," and he added a reaffirmation of "his faith in the coin-box Telemeter system as being the most practical for Pay-As-You-See television."

Nice going even for Balaban, whose company has made billions out of motion picture theatres for many years in the form of film rentals. His right to an opinion in the matter is indisputable —but his crack about Sarnoff's "pious declarations" should have been accompanied by a frank statement that Paramount Pictures *owns* Telemeter. Also, that Paramount Pictures have been charging motion picture theatres *within the past year* playing-time percentages of up to 70% of the net income, the latter being determined *by Paramount!*

It is expected that the Toll-Tv hot potato will be passed on by the Federal Communications Commission to the Congress of the U. S. A., where one

Pictured here are the guests of honor at the recent 40th anniversary celebration of Local 626, Nashville, Tenn. Left to right: E. B. Hester, vice-president, Tennessee Federation of Labor; W. H. Parham, State Commissioner of Labor and member of Local 626; IA President Richard F. Walsh; W. J. Brown, toastmaster and secretary of the Local; Charles Houk, secretary-treasurer, Tennessee Federation of Labor; Hon. Ben West, Mayor of Nashville; A. S. Johnstone, IA sixth vice-president and member of New Orleans Local 293; R. M. Martin, treasurer of Local 626; and Maynard Baird special IA representative and member of Local 405, Knoxville, Tenn. Among the invited guests were representatives of more than 25 IA Locals.

The IA Executive Board will hold its regular mid-summer meeting at the Bismark Hotel in Chicago the week beginning August 8.

may be sure that every member will have his back-home antenna adjusted to its maximum height. Millions of words will be spilled, but assuredly the truth about the use of *existing* facilities will finally emerge. With the traditionally labor-conscious Democrats in control of Congress, it will be *something* to see them go along with *not* quarter-in-a-slot but dollar-in-a-slot Toll-Tv—*plus* installation and equipment costs to the average homeowner.

We haven't yet mentioned the installation, servicing and money-collection worries of the Toll-Tv boys. That's *their* headache, as yet unrelieved.

You know, Toll-Tv might possibly prove a boon to all entertainment enterprises. In the small- and medium-sized towns and cities having only one channel, the subscriber might not like the Toll-Tv show in a given 8-to-10 p.m. slot. This might drive him out of the house to a tavern, to the ballpark, or even to the movie theatre. So be it.

Every wage-earner, affiliated with a national organization or not, should battle Toll-Tv to the point of its extinction.

● Technicians and engineers employed at stations WOR and WOR-TV, New York City, last month chose the IATSE as their bargaining agent. In an election conducted by the National Labor Relations Board, 98 votes were cast in favor of the IA, and 10 for the IBEW (International Brotherhood of Electrical Workers) former bargaining agent for these employes.

At present, representation of engineers and video cameramen at the six Tv stations in New York City is equally divided among three competing unions—those at DuMont's WABD and WOR-TV are covered by the IATSE; WPIX and WCBS-TV by the IBEW; and WRCA-TV and WABC-TV by NABET (National Association of Broadcast Employes and Technicians).

In another election held early this month, graphic artists employed by the CBS studios in New York City voted unanimously for IA representation. They will be affiliated with the IA's Radio and Television department, which already covers a number of other CBS groups. In addition, CBS carpenters, electricians, propertymen, makeup artists, wardrobe attendants, and film cameramen are represented by New York City IA Locals.

● Gold life-membership cards in Detroit Local 199 were awarded to 10 of its charter members at a recent midnight banquet. IA President Walsh was the principal speaker at the affair and he also made the gold-card presentations on behalf of the Local. The honored members are Lloyd Burrows, Henry F. Falk, Edward Foster, William Jose, Bud Kirby, Sherman J. Lambly, John Mac Donald, Earl J. McGlinnen, Cass Newell, and James Powers, Sr.

● Under the terms of a three-year contract recently concluded between Local 241, Vallejo, Calif. and theatre exhibitors in Contra Costa, Solano, and Napa Counties, the members of the Local will receive a 10c-per-hour wage increase for the first two years, retroactive to February, 1954, when contract negotiations began, and an additional 5c per hour for the third year.

The pact also provides for two weeks' paid vacation for each year of employment. Swing-men and part-time employes will be eligible for vacation pay based on a pro rata of 40 hours per week. An important part of the vacation clause in the contract is as follows:

"Projectionists who permanently sever their regular employment with a company or theatre at any time after one month of regular employment shall be compensated for that portion of vacation time earned on the basis of one-sixth of their basic weekly salary for each full month's employment."

The 5c-per-hour paid by the employers to the Local's Health and Welfare Fund has been extended to include paid vacation shifts. Daniel W. Akin, business representative, was in charge of negotiations for the Local.

● By an overwhelming majority of 170 to 8, the Screen Publicists Guild, representing "drumbeaters" in the movies, Tv, and radio voted in favor of affiliation with the IA. The decision highlighted three months of study and investigation into possible affiliation with other organizations. The Guild was formerly associated with the Painters International.

● District No. 10, comprised of IA Locals in the state of New York, held its annual convention at the Statler Hotel in Buffalo on July 17. The annual convention of the State Federation of Labor opened there the day following.

OBITUARIES

Adam Louis Tennis, 65, member of Local 337, Utica, N. Y., died suddenly on June 17. A resident of Utica for the past 50 years, he worked in the projection room of the Avon Theatre there since it opened about 30 years ago. Besides his wife, he is survived by his mother, one daughter, one sister, and two brothers.

Carl Beals, 43, member of Detroit Local 199, died last month. At the time of his death he was a projectionist at the Colonial Theatre. He is survived by his wife and three children.

Ernest R. Terrill, 80, member of Local 337, Utica, N. Y., died last month after a long illness. Prior to his last illness he worked in many of the theatres in the Utica area. He was a member of Shenandoah Lodge 95, Odd Fellows; Oriental Lodge 224, F & AM; Utica Post 229, American Legion Band; Tigris Temple in Syracuse, and Mohawk Valley Consistory. Survivors are his wife, two sons, eight grandchildren, and a great grandchild.

Joseph S. Griggs, 54, member of Local 386, Columbus, Ohio, died of a heart attack on June 12. He was stricken while doing relief work in the projection room of the Uptown Theatre there. He was regularly employed at the Garden Theatre in Columbus. He is survived by his wife, daughter and step-daughter.

William J. Jarvis, 65, member of Local 285, Troy, N. Y., died last month after a lingering illness. At the time of his death he was chief projectionist at the Troy Theatre there. He was one of the old-line members of Local 285, and many years ago he traveled with the D. W. Griffith feature "Hearts of the World."

Thomas A. DeSchantz, member of Pittsburgh Local 171 and projectionist for many years at the Regent Theatre in East Liberty (Penna.), died recently at the Columbia Hospital.

IA ELECTION

LOCAL 628, CHARLEROI, PENNA.

James A. Woods, *pres.*; Carl Hanel, *vice-pres.*; Joe Petrosky, *treas.*; Tip Hodgson, *fin.-sec.*; Kirk McLain, *cor.-sec.*; R. J. Crosby, *bus. rep.*; Armand Lorenzi, *sgt.-at-arms*; E. A. Leinbach, Anthony Lorenzi, and Victor McCrory, *trustees.*

Congratulations are in order from H. M. Bessey (right) executive vice-president of Altec Service Corp., as Marty Wolf assumed post of sales manager on July 1.

Lens Calculation Formulae

To the Editor of IP:

Please give me the proper formulae for calculating the following:

1. Size of Lens
2. Throw
3. Size of Screen

H. ABBOTT

Victoria, B. C., Canada

EDITOR'S COMMENT: Here are the standard formulae for computing (1) equivalent focus of projection lens, (2) "projection distance," or throw, and (3) size of picture on screen. It must be understood at the outset that all dimensions should be in the *same* units of measurement. In American and British practice *inches* are used because the dimensions of projector apertures are usually stated in fractions of an inch. It is absolutely necessary, therefore, to convert the throw and screen-picture dimensions into inches when using these formulae. (Multiply all distances and dimensions which are given *in feet* by 12.)

A. FOR STANDARD (NON-ANAMORPHIC) PICTURES

1—Focal Length of Lens:

$$\text{Lens Focus} = \frac{\text{Throw x Aperture Width}}{\text{Picture Width on Screen}}$$

2—Throw:

$$\text{Throw} = \frac{\text{Lens Focus x Picture Width on Screen}}{\text{Aperture Width}}$$

3—Size of Screen: *(a)* Height:

$$\text{Picture Height on Screen} = \frac{\text{Throw x Aperture Height}}{\text{Lens Focus}}$$

(b) Width:

$$\text{Picture Width on Screen} = \frac{\text{Throw x Aperture Width}}{\text{Lens Focus}}$$

B. FOR CINEMASCOPE (EXPANDED-IN-WIDTH) PICTURES

1—Focal Length of Lens:

$$\text{Lens Focus} = \frac{\text{Throw x Aperture Width x 2}}{\text{Picture Width on Screen}}$$

2—Throw:

$$\text{Throw} = \frac{\text{Lens Focus x Picture Width on Screen}}{\text{Aperture Width x 2}}$$

3—Size of Screen: *(a) Height:*

$$\text{Picture Height on Screen} = \frac{\text{Throw x Aperture Height}}{\text{Lens Focus}}$$

(b) Width:

$$\text{Picture Width on Screen} = \frac{\text{Throw x Aperture Width x 2}}{\text{Lens Focus}}$$

The first four of these eight formulae should be memorized. The last four—the formulae for anamorphic pictures—are obtained from the first four merely by multiplying aperture-width by 2, the "expansion-factor" of the CinemaScope anamorphic lens. Aperture-height, it will be noticed, is not affected by the anamorphic attachment.

Projectionists who are handy with algebraic transformations need only memorize the following "master equation" in which D is the picture dimension (height or width) on the screen, f is the E.F. of the lens, d is the aperture height or width, E is the anamorphic expansion factor (1 for non-anamorphic standard projection, 2 for CinemaScope), and T is the throw.

$$Df = TdE$$

From the foregoing equation are derived:

$$f = \frac{TdE}{D}, \quad T = \frac{fD}{dE}, \quad \text{and} \quad D = \frac{Tde}{f}$$

In regard to aperture dimensions, it may be helpful to keep in mind that all normal non-anamorphic apertures are 0.825 of an inch in width. CinemaScope aperture-widths, on the other hand, are 0.839 inch for optical sound, 0.910 inch for magnetic, and 0.715 inch for the undersized 2/1 aspect ratio.

Aperture heights vary greatly, depending on aspect ratio. All three of the CinemaScope apertures mentioned above, however, are uniformly 0.715 inch high. The standard non-anamorphic aperture (aspect ratio 1.375/1) is 0.600 inch high. Widescreen apertures have the following heights:

1.66/1	aspect	ratio,	0.497	inch
1.75/1	"	"	0.471	"
1.85/1	"	"	0.446	"
2/1	"	"	0.412	"

These aperture width and height data must be used in the formulae previously given.

Magnetic Repro Advances

To the Editor of IP:

Extraordinary lengths have been gone to in the design of heads now being manufactured by Ampex, and by other magnetic equipment producers, to assure that the material will in no way damage the sound tracks or the film to which they are attached.

Any research on new materials must turn up a material which has the same degree of safety in operation as materials now in use, which make the problem severe indeed. Not only must the heads themselves be designed so as to produce no damage to the film, but the magnetic reproducer mechanical system must be carefully manufactured so that no part can scratch the film as it passes through the mechanism. Much emphasis has also gone into this aspect of the design of these machines.

4 Million Film Feet Wear Now

As for the wear characteristics of materials currently used in Ampex reproducing heads, these are guaranteed for more than four million feet of operation at the present time! Extensive analysis of Ampex heads in use in theatres makes it appear that substantially more than this is being obtained from the largest proportion.

This is not to say, of course, that further extensions in life are unnecessary or undesirable, but that such extensions, if made, must *not* be made at the expense of other desirable operating characteristics.

There are several reliable materials which hold promise of good electrical and film safety characteristics, all of which are under intensive investigation here. We are not, at this time, however, in a position to advise you of definitive results. Each material has disadvantages, and only rather extensive research will establish which among them offers the best compromise of desirable characteristics.

P. L. GUNDY

Manager, Audio Division
Ampex Corp., Redwood City, California

Giant Eastern Tv-Film Lab

Plans to build what is described as "the largest Tv film processing laboratory in the world" in New York were announced this month by Consolidated Film Labs. Located on West 57th Street between 10th and 11th Avenues, the plant is expected to open September next.

While developing and printing of theatrical films will not be entirely excluded, the facilities of the new lab will be devoted primarily to the needs of Eastern Tv producers.

'Cinemaplastic' White Screen Coating

By LEONARD SATZ
Raytone Screen Corporation

CINEMAPLASTIC is a white screen paint with a high-vinyl solids content. After the last World War, the Armed Forces made great use of a similar product for "moth-balling" the Fleet and, also, many types of large bombing planes. The resistance of this material to the elements prompted the development of this product for drive-in theatres. It is completely waterproof and weatherproof, and has extremely high adhesion to all types of screen surfaces.

The ideal situation would be the application of Cinemaplastic on the unfinished screen surfacing; however, if a previously painted surface is in good condition without evidence of blistering, peeling or flaking, Cinemaplastic will adhere to the old surface with great strength and form a plastic bond that will protect the old coating and the screen tower from the weather.

Being a true vinyl plastic material, when applied it becomes a tough flexible skin that will expand and contract with extremes of heat and cold. It is completely washable and can even be steam-heated. Furthermore, since it has such a high solids content and actually forms a "skin," it is the best plastic devised so far for filling joints and seams on the average screen tower. Caulking or filling of seams is not required.

Spray Application Method

Cinemaplastic is applied with a spray technique, and because of its heavy body, the coverage does not exceed 100 square feet of surface for each 1½ gallons of the material. Specific instructions are furnished for application, and a large commercial spray outfit with a rating of at least 60 cubic feet of air per minute is required for good results. A paint pot with agitator, an oil and water extractor and pressure regulators, are required for perfect results.

Since the material has a slight eggshell gloss, the technique of application should impart an "orange peel," or stippled surface, for perfect diffusion.

This material was subjected to extremely rigid tests in a fadeometer for fastness to light, which determines the degree of "yellowing", which was rated negligible. These same samples were further tested for resistance to accelerated weathering, using Federal Specification test methods that employ an arclamp source with 180-minute cycles of water spray. Upon completion of exposure, the test panels exhibited a negligible amount of water-spotting. No other degradation was evident.

Tests Tend to Prove Longevity

Summing this up, it can be reported that the tests were eminently satisfactory, and quite unusual for a product of this kind. Since this is a white screen surfacing agent, the brightness gain and distribution of a white theatre screen can be expected. It is not a high-gain or specular surface such as that produced by metallic aluminum paints.

A few hundred installations have been completed with this process, and Cinemaplastic screens now two years old are still in a wholly usable condition. With careful evaluation, it is the opinion of the manufacturer that this product should last outdoors for 7 to 8 years before requiring resurfacing. It may well last longer.

PERSONAL NOTES

RALPH B. AUSTRIAN has been appointed West Coast manager for Allen B. Du Mont Laboratories. Supervising all DuMont activities, he will make his offices in Los Angeles and will be in charge of sales as well as government contract, research and development work. He was recently senior assistant with Charles Luckman in the firm of Pereira & Luckman.

L. DOUGLAS NETTER, JR., formerly with Altec Service Corp., has been appointed vice-president of the Todd-AO equipment division. Netter inaugurated the Altec sales drive and headed the sales promotion drive which marked the activities of Altec in behalf of several thousand CinemaScope and stereophonic sound installations. Prior to his Altec assignment he was sales manager for the non-theatrical films sales department of Pathe Industries.

ALEXANDER F. VICTOR, founder of Victor Animatograph Corp., Davenport, Iowa, was recently honored by the Department of Audio-Visual Instruction, National Education Association. The NEA cited his contributions to the use of the motion picture in education and lauded his efforts in the establishment of a safety standard for non-theatrical film with a commendatory scroll. It also acknowledged and credited Victor with the first safety standard projector (28 mm), the first 16-mm motion picture camera and projector, and the optical sound reduction printer.

JAY H. QUINN has resigned as manager of sales and advertising of the Fairchild Recording Equipment Co. He plans to establish a sales company in the N. Y. City territory catering to radio studios, broadcast stations, recording studios, etc., with professional quality items.

GRANT U. MYERS has been appointed vice-president and comptroller of the Radiant Manufacturing Corp., Chicago, producers of projection screens. Formerly manager of plant accounting at the Wisconsin Steel Works of International Harvester Co., Myers is a member of the executive program of the University of Chicago.

More on Cleaning Lenses

To the Editor of IP:

I read "Oops; Says IP on Lens-Cleaning Data" in the May issue of IP (p. 28), and was happy to note IP's views on the subject. For many years we have advised the industry to use a lens cleaner void of soapy ingredients. Our lens tissue is made to government specifications and used by all of the Armed Forces and optical industrial establishments. Finely textured, it doesn't scratch the finest clear or coated lenses. The lens tissue book is sized 4 x 6 inches and contains 100 perforated sheets which may be extracted without tearing.

A. LEE
Rosco Labs, Brooklyn, N. Y.

Why High-Speed Optics?

The larger picture area requires additional light. This being so, an F:1.7 or F:1.8 lens, as compared with lenses of slower speed, is a distinct advantage, because it delivers to the screen an eye-filling 20% increase in light.

It is understood, of course, that unless the entire optical train from reflector or condenser set-up be in proper alignment, the advantages accruing from any fine optics will be dissipated. "High speed," optically speaking, is of no value whatsoever unless the other elements in the projection train (particularly the working-distance from either the reflector or the condenser combination) are in proper order.

Unless the entire optical train be in proper alignment, the best lens in the world will deliver unsatisfactory projection screen results.

This Business of Toll-Tv

ONE of the most pressing social and economic problems confronting the motion picture industry today—in terms of *exhibition*, that is, theatres—is that of pay-as-you-see Toll-Tv. To date, IP has refrained from any active editorial participation in this arena for the simple reason that it never believed that the sponsors of Toll-Tv would get away with that which they now contemplate.

But IP's thinking in this direction was abruptly short-circuited when it became apparent (by the route of certain private information) that the sponsors of Toll-Tv had in mind *not* an *extension* of present facilities (the movie theatre, aural radio and Tv stations) but a take-over thereof. We refer our readers to the comment appearing in the "In The Spotlight" department of this issue.

Here is a compendium of questions and answers which, while frankly the product of an outfit which favors our point of view (Organization for Free Tv) is nevertheless a group which furthers the cause in which IP believes:

QUESTION: *What is Pay-To-See television?*

ANSWER: It is a scheme to make *you* pay for Tv programs.

QUESTION: *How does it work?*

ANSWER: Fundamentally, it is an electronic method of "scrambling" the reception on your Tv picture and sound so as to make it absolutely worthless. The second step is to "unscramble" picture and sound, for a price, to be collected from every Tv set-owner who wants to see the program. All proposed systems operate on this basic pattern.

QUESTION: *Why do I hear this invention described as a "modern miracle?"*

ANSWER: For no reason except, perhaps, that it would be a miracle if the American public tolerates such an outright and unwarranted invasion of its rights. Today's Tv picture-and-sound transmission really is a miracle. Pay-To-See Tv does nothing but Distort this picture and sound.

QUESTION: *Does Pay-To-See Tv represent "progress," as its proponents claim?*

ANSWER: No, because in no sense whatever is it creative, as were the automobile, the airplane, and broadcast facilities. In addition, taking something that the public is getting *free* and making them pay for it, for personal profit to a few patent-holders, is selfish and un-American.

CLAIM: *As a part-time, new service, Pay-To-See-Tv would add to regular television by delivering "premiums" in entertainment from stage, screen, concert hall and stadium, as well as whole chapters of knowledge usually confined to textbooks, classrooms, or laboratory presentation.*

THE FACTS: In any given year, there aren't more than a dozen "extraordinary" shows—and those are the ones meant by "premiums." That raises this problem: what happens when they run out of "premium" shows?

Their claim that they are going to bring you whole chapters of knowledge usually confined to textbook, classroom, or laboratory is misleading. Right at this moment, there are scores of outstanding programs of this nature being telecast free over networks and local stations all over the U. S.

CLAIM: *Pay-To-See Tv, described as a supplement of free programming, would enter the present structure of the entertainment business as a healthy competitor.*

THE FACTS: It is not a supplement but a substitute for Free-Tv shows. Being in no respect whatever a creative aim, Pay-To-See is a competitor for profit, and nothing else. What we have here is an astonishingly frank announcement that the Pay-To-See group intends to buck the Free-Tv structure and, by every means at its disposal, seek to destroy it.

CLAIM: *Pay-To-See Tv does not replace Tv programs.*

THE FACTS: How can two programs come over one channel? If you don't pay, there is *nothing else to see.*

CLAIM: *The programs which Pay-To-See Tv could bring viewers are "cultural commodities" now paid for outside the home in theatres, movie houses, stadiums, arenas and other public places.*

THE FACTS: Free-Tv offers a dozen "cultural commodities," at least, in any week of the year. It is pure nonsense to pretend that Pay-To-See Tv can provide more or better cultural programs than Free-Tv. This certainly holds true, too, in any branch of science, music or the arts, all of which have been generously presented on Free-Tv. The best recent example is the outstanding coverage provided by Tv and radio to the story of the Salk polio vaccine research and results.

CLAIM: *Pay-To-See Tv, in bringing fine films and plays to millions in the home, would still not "do away with the theatre." Two box-offices mean more and better "theatre" for all.*

THE FACTS: This claim is ridiculous. A producer who telecasts a movie or a play directly into the home clearly and distinctly by-passes the theatre, making it obsolete and unpatronized.

CLAIM: *Pay-To-See Tv would help movie producers, sports promoters, and legitimate theatre owners by giving them a gigantic outlet for their new products.*

THE FACTS: The "gigantic outlet" referred to, it must be emphasized, was created by Free-Tv. Now that it has been established a handful of men are trying desperately to take it over. These men are fully aware of the appeal to producers and promoters—no real estate taxes, no unemployment taxes, no social security benefits, no pay-roll to meet. And, clearly, the producers and promoters will not have to meet these obligations if they abandon their theatres, playhouses, and arenas. But just as clearly, thousands of wage earners will lose their jobs. Thus, the handful of men will profit tremendously while the country as a whole suffers seriously.

CLAIM: *With Pay-To-See Tv you could experience the thrill of an opening night on Broadway for a fraction of box-office prices.*

THE FACTS: A top NBC engineer states flatly that that claim is an absurdity. (1) No Broadway theatre is physically equipped to bring a play to the television audience; (2) once a Broadway theatre is equipped to transmit a play via television it is no longer a theatre and thus cannot accommodate an opening night audience; (3) to convert a Broadway theatre so that it can telecast a play, the *very first step* is to rip out the first 25 to 30 rows of seats . . . exactly the seats used by the persons who make the first night what it is.

CLAIM: *Pay-To-See Tv would make available anything the public wanted to see at a fraction of the cost of attending.*

THE FACTS: A recent telecast of "Peter Pan" was watched without charge by about 60 million people. Pay-To-See Tv proponents admittedly would have charged its subscribers 50 cents per set to watch it, in addition

to which the subscribers would have had to pay for a gadget costing between (at present figures) 75 and 100 dollars.

Consider the set-owner. He must purchase the unique and exclusive gadget put out by the company which is bringing him the play, film or sports event. Now, with three companies bidding for "premium" shows, the set-owner, if he wants to see all these shows, may have to purchase three separate gadgets to keep up with the Pay-To-See Tv. The entire notion of being compelled to purchase these gadgets is ludicrous.

CLAIM: *Pay-To-See Tv operates on credit, billing the viewer on the basis of holes punched in cards by the decoder, or on a cash basis.*

THE FACTS: Do you want a collector in your home? The decoder, by itself, is not enough. In addition, the set-owner must purchase a "cash-register" which is attached to his set. This operates along with a card he has bought, to unscramble the picture.

Practically everyone is aware of what a sensitive instrument is a television set. The un-scrambling process may well lead to trouble with the set—the sort of trouble that means loss of the "picture." On any Pay-To-See Tv basis, the set owner will have no way yet described to get his money back if unscrambling results in "picture" failure.

CLAIM: *Pay-To-See Tv is a system whereby the program viewer can make direct payment to high-quality programs.*

THE FACTS: To obtain high-quality Tv programs, there is only one place the "slot-machine network" can turn to for talent—that place is Free-Tv. High quality, moreover, is a master of taste, and thus is impossible to guarantee. The only certain thing here is that the set-owner will not get his money back if the Pay-To-See Tv program doesn't please him.

CLAIM: *Zenith Radio Corp.'s Phonevision laboratory has produced the devices necessary to make subscription television successful.*

THE FACTS: Subscriber-Vision (Skiatron, Inc.) and Telemeter (Paramount Pictures) also in the business of furnishing Pay-To-See Tv gadgets, *just happen* to have equipment which the set-owner may have to buy. Which will you buy? Do you know?

Here an unfortunate and expensive dilemma suggests itself: A set-owner who is unaware of this competition may buy a gadget that can bring him only the programs owned by the company which produced the gadget. All others are blacked out.

CLAIM: *Pay-To-See Tv equipment will not interfere with the use of a broad-*

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casting station's transmitter for regular commercial traffic.

THE FACTS: *The above is just not true.* It is impossible to transmit both Paid-For shows and Free shows at the same time. The set-owner who does not purchase Pay-To-See equipment cannot receive anything from that station until the Paid-For show is over.

CLAIM: *Pay-To-See Tv will be operated as a new, part-time service by UHF Tv stations only.*

THE FACTS: In the beginning, maybe, but only an incredibly naive person would believe it would continue that way. Once established, the Pay-To-See group will capture all the talent and all the networks Free-Tv uses today and sell it back at a high price to the set-owner. There is always the threat that television then will become a closed corporation—open only to Pay-To-See Tv subscribers at a price.

CLAIM: *Pay-To-See Tv will not affect today's pattern of sponsored television but will introduce new programs.*

THE FACTS: Again, this just is not true. Proponents openly declare they will charge money for the World Series, championship fights and other sports events now fully covered on Free-Tv.

But they do not stop at sports programs. Here are excerpts from a letter written by the Public Relations Director of Zenith Radio Corp. on March 25, 1955, to every television station operator in the United States.

"On March 7, 65 million people watched "Peter Pan" and the reaction from every segment of the industry and the public was overwhelmingly favorable. According to figures quoted to us, it cost something more than $600,000 to put "Peter Pan" on the air. It is *exactly the kind of entertainment* which subscription television could bring to the home viewer, and to your station as a *regular weekly event.* While the sum of $600,000 for a single program is staggering to a sponsor, it represents *less than 1 cent per viewer* for the "Peter Pan" audience. On subscription television and With The Same Audience Paying Only 25 cents per set to watch the attraction at home, the box-office would have amounted to $5,000,000 for division among producers, distributors, and broadcasters."

Does this sound as though the "slot-machine boys" will keep their hands off today's Free-Tv? Of course not, and they know it, even though they continually mouth insincere promises that they have no designs on today's top programs!

CLAIM: *Pay-To-See Tv will be received on Tv sets now owned by the public.*

THE FACTS: The attempt in the above claim is to avoid stating the hard fact that a set-owner must buy a gadget and a code-card or slot-machine device before he can watch any Pay-To-See Tv program . . . both of which are attached to his present set.

CLAIM: *The actual cost per Pay-To-See Tv program to viewers would undoubtedly vary, depending upon the nature and length of the "premium event" that is being televised, but would be only a fraction of the box-office prices.*

THE FACTS: The only cost at present to a set-owner is the cost of his Tv set. Under the Pay-To-See Tv plan, the cost of the gadget will be added, the cost of the decoder will be added, installation charges will be added, and, finally, the cost of each program will be added. Thus, the cost of seeing these so-called "premium shows" may well run, in a year's time, to from $375 to $1,125 per family, over and above initial costs for necessary equipment and installation.

This added expense is entirely without justification in view of constantly improving Free-Tv programs.

CLAIM: *With Pay-To-See Tv as an added service available to broadcasters, television stations would have revenue from both Pay-To-See Tv and advertising sponsors.*

THE FACTS: This is an excellent example of the misleading claims being made by the Pay-To-See group. Pay-To-See Tv is not an added service. Actually, it takes away service now available to set-owners free of charge. Broadcasters, it should be remembered, will always have to *substitute* a slot machine program for one they have been offering free. Furthermore, when the *same* time is used, how can it mean additional revenue?

CLAIM: *If the opening night of a Broadway play were put on Pay-To-See Tv enough money would be obtained from a nation-wide audience to pay the cost of the play's production.*

THE FACTS: But if this were done, would you have a theatre left in this country? Also, who has specified what the cost would be?

In the above, no mention whatever is made of damage such a program would bring to the theatrical road-companies. Nor is there any mention of what such a program would do to at-

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tendance at the Broadway theatre where the televised play is housed.

There is no doubt that such a program would pay for the costs of the play's production. The fact is that it could return it a thousand times over . . . and the fact is that none of this additional revenue would find its way into the hands of talent and other employees deprived of an opportunity to work in theatrical road-companies.

CLAIM: *Hollywood, Broadway, and television itself would benefit from the surge of economic support from the living-room box-office in Pay-To-See Tv.*

THE FACTS: Let no one forget the common practice among producers to raise prices when they have a good attraction. Once Pay-To-See Tv has a nation-wide audience, the television stations will have to yield to the demands of Pay-To-See promoters or not get the product. Moreover, if there is only one source of distribution, who would get what?

CLAIM: *Pay-To-See Tv would make it possible for many events, now televised exclusively to theatres or "blacked out" in towns where they are staged, to be seen at home.*

THE FACTS: The few "black-outs" in sports lend great support to the case for Free-Tv. Advertisers have been bringing the public championship fights, World Series, and football—all of which are available free to the viewing public. Moreover, theatre Tv does not use Free airways, but pays established rates to a common carrier for a closed circuit for its events. Here again, there is evidence of Pay-To-See Tv's basic unfair competition.

CLAIM: *Pay-To-See Tv would give all sports needed economic support with a home box-office, especially college athletics and minor league baseball, two important victims of the televising of sports without a box-office.*

THE FACTS: The above contains a transparent fallacy, to wit: the poorer teams who draw no attendance at the gate are certainly not going to draw attendance at home. Furthermore, people still pay to watch football in stadiums, while others still get it free on television.

Pay-To-See Tv's argument that it would be only a part-time service is simply not true. Baseball, obtained free today, almost always consumes between 2½ and 3 hours, meaning, of course, that all other programs on that channel would be cut off.

CLAIM: *Pay-To-See Tv would help the movie theatres by stimulating interest*

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in movies and greatly increase the output of films.

THE FACTS: The above contains a basic contradiction since it is a well-established fact that a large output of films invariably means inferior films, hardly fit to be called "premium" entertainment. Again, it entirely overlooks the disastrous economic consequence to movie-house employees and to thousands of people employed in related fields, restaurants, transportation workers, etc.

Finally, Pay-To-See Tv in no sense guarantees a stimulus for interest in the movies. The interest is there now . . . and only good pictures can be the stimulus.

CLAIM: *College students would find it possible to accumulate as much as half or more of the necessary credits for graduation at home, and with far less expense than when actually attending college. This would make degrees possible for thousands who cannot afford the time or expense of four full years of "on campus" residence.*

THE FACTS: Just words without rhyme or reason. It would lead to the most superficial educational processes imaginable, and establish education without standards. Television education can be useful as a supplementary factor, but not beyond that, as 99% of our educators will attest.

CLAIM: *Pay-To-See Tv would greatly multiply the total audience for Tv, by making more stations possible, especially in the smaller towns, and by giving more people reasons to buy and use television sets.*

THE FACTS: Those who do not have Tv sets today almost certainly can't afford them, which would make the above claim nothing short of ridiculous. Another point is this: if a station can't operate successfully in a "free market" because it can't attract a large enough audience, it certainly can't hope to succeed when programs have to be paid for.

CLAIM: *We have the solution to the economic problems that have reduced the status of the opera and symphony.*

THE FACTS: Any lack of status incurred by the opera and the symphony is highly debatable and would certainly have to be proved. What Pay-To-See Tv actually is saying here is that it, by itself, is going to elevate the musical tastes of millions of people. That is rubbish.

CLAIM: *Pay To-See Tv would give the public the kind of top entertainment that advertisers cannot afford to sponsor.*

THE FACTS: Any entertainment that advertisers can't afford to sponsor would be so utterly unfamiliar to the American people that it is extremely unlikely that they would accept it. Besides, what artist, show, or program has failed to get an airing?

CLAIM: *Pay-To-See Tv would help advertisers, even though it took away some of their air time, because it would make for more stations and permit reduced rates.*

THE FACTS: Free-Tv and Pay-To-See Tv cannot co-exist. It would become unprofitable, eventually, for advertisers to sponsor Free-Tv, owing to the alienation of part of their audience to Pay-To-See Tv. In Tv, small audiences lead to less programming, until the point where there would be little or no Free-Tv at all.

MAGNETIC PRINT DATA

(Continued from page 17)

netic field—a method which does not give as good results as re-recording on the print tracks.

Mr. Grignon implies, however, that an actual re-recording technique is employed by Fox in the preparation of magnetic-track release prints. We are open to correction.

Deterioration Breeds Distortion

Another factor of great importance is the proximity of the magnetic-track material to the reproducing head of the "penthouse" reproducer, as error in this respect produces severe second-harmonic distortion. We regard the standardized gap distance as correct for reproduction of magnetic tracks of the C'Scope variety, but are totally unable to grasp any advantage of the *very slightly* superior high-frequency response of this system when *both* the prints and the reproducing heads are new and in good condition.

Beyond a certain point of wear, the magnetic heads deteriorate in a

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rather spectacular manner, and unless the soundhead has been designed for good contact of the film with the heads, distortion is inevitably present. Optical sound performs ably even in spite of slight soundhead wear and print deterioration. In other words, optical sound is stable and dependable, whereas magnetic sound is not.

What Mr. Grignon says about extending the low-frequency range with a raising of the high-frequency end of the sound response is absolutely true, and a lesson equally applicable to optical sound. In practice, C'Scope magnetic sound reproduction cannot go much below 50 cycles because of the design of the amplifier transformers made by most of the commercial manufacturers of sound equipment.

The same limitation applies to optical sound; but the reasons are different—ground noise and low output power of the average theatre amplifier. Moreover, satisfactory reproduction of the lower frequencies —down to about 35 cycles—demands low-frequency speakers of larger and more rugged design than anything that has yet been offered by the commercial manufacturers.

Cyclic Cut-Off Point

It is a defect of the Perspecta "pseudo-stereophonic" system of optical-track reproduction that it cuts off from reproduction everything below 70 cycles. In the matter of low-frequency reproduction, therefore, C'Scope magnetic sound is superior to Perspecta sound, as presently constituted. This is not a limitation of optical sound, however, for an adequate theatre sound system will render audible frequencies as low as 60 cycles from standard optical tracks, although with very great attenuation of the signal.

The question of C'Scope magnetic *vs.* standard optical sound for theatre use has been settled, it seems to us. This, we might say, is a fact of commercial life and in no wise diminishes our admiration for Fox or for the manifest skill and ingenuity of Fox engineers.

Like many other motion picture processes (our memory goes back to sound-on-disk, a system superior to the optical sound of its day) magnetic sound reproduction finds its days numbered. While all five of the major producers in Hollywood have been doing a fine job with it, all except Fox have conceded to the viewpoint of Paramount and concentrated on the technological advance of optical sound with the intention of totally abandoning magnetic sound.

It is possible that the 2½-channel stereophonic sound system of optical-track reproduction, known as PhotoStereoSound,[1] will eventually be adopted as standard.

[1] Dr. John G. Frayne, "New PhotoStereo Sound System", I. P., p. 24, June 1955.

BLACK-AND-WHITE FILM

(Continued from page 15)

base. The earlier acetate films were unsatisfactory as regards their physical properties. They retained more solvent than nitrate film, and as this solvent evaporated they shrank, until finally they might not fit the sprockets. The shrinkage also manifested itself as buckle and curl.

Nevertheless, safety positive film was made in appreciable quantities before 1916 and has been made ever since. It was absolutely necessary for projectors used without a projection room. Safety film, as will be seen Improvements in the acetate base were continuous until 1950, when a marked change was made by the adoption of later, also played a great part in the development of the 16-mm program. triacetate base.

Cellulose triacetate gives much improved physical qualities to the base, compared with the earlier material which contains slightly less acetyl in the structure of the molecules. As a result, the triacetate base proved to be as suitable as the earlier nitrate base. In 1950 nitrate base was discontinued, and from the beginning of 1951 all film has been made on the

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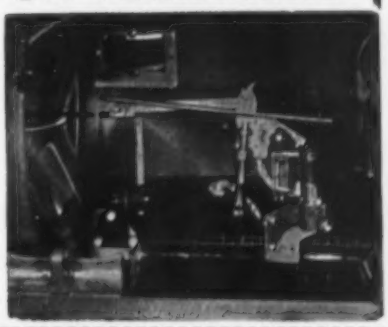

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Since 1928, safety film has been distinguished by the substitution of Type 5 for 1 as the initial number. Thus, Plus-X Panchromatic Negative is now known as Type 5231, and Fine Grain Release Positive as Type 5302.

Wide-Scale 16-mm Development

The first 16-mm film was introduced in 1923 as part of a program of home cinematography. An orthochromatic film, Type 5204, was first manufactured in May 1923 under the name of Kodak Safety Film for the Cine-Kodak and other cameras using 16-mm film. This film, after exposure in the camera, was from the beginning developed by a reversal process to a positive and used as a final print for projection. It was this system which was responsible for the success of the 16-mm program which has had such wide application in the whole development of motion pictures.

Panchromatic Cine-Kodak Film, Type 5255, was placed on the market in 1928. The camera film was first supplied for daylight loading with a paper leader. Many experiments were made on the use of an opaque backing to avoid the troubles involved in the use of the paper leader. Finally, in 1931, a jet-black backing was made which gave the necessary protection to the film and which was removed in the processing machines.

Supersensitive Panchromatic

Supersensitive Cine-Kodak Panchromatic Type 5256 was introduced early in 1931, and this was replaced in 1939 by Super-X Cine-Kodak Panchromatic Film having the same type number, 5256, which is a current product. In 1938 Super-XX Cine-Kodak Panchromatic Film, Type 5261, supplied the need for an ultra-speed reversal film.

Undoubtedly, new black-and-white films for use in motion-picture photography will be introduced from time to time and will embody improvements made possible by the advance of the emulsion-maker's art. The future of motion-picture photography, however, involves the use of color, and the principal advances in motion-picture films will depend upon the improvement of the materials and processes used for color photography.

DAMAGE TO PRINTS

(Continued from page 10)

degree of tightness. Loose winding may be avoided by maintaining proper tension of the "dummy" brake. Loosely-wound rolls of film should be rewound twice more, and never tightened by pulling down on the *outer* lap of film.

The speed of the motor-driven rewinder should be somewhere between 2½- and 5 times normal projection speed. That is, a 2000-foot reel of film should rewind in from 4 to 8 minutes. Faster rewinding may damage the film; slower rewinding is a nuisance.

Vibration on the reels and sidewise film-slapping on the rewinder make an even rewinding impossible. A few projectionists have devised flanged guiding rollers under which the film passes on its way from one reel to the other. Such rollers must be "faced" to contact only the perforation margins, never the soundtrack and picture areas.

Rewinder elements are sometimes deliberately misaligned so that the film rubs against the reel flanges and is thus guided into an evenly-wound roll. This method, unfortunately, results in

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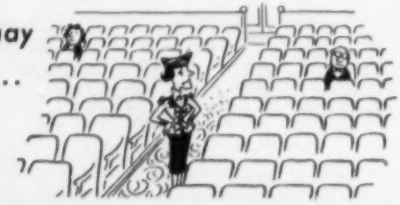

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roughened and nicked edges, torn perforation margins, and damaged splices. Curved diagonal abrasions are sometimes produced when the film is held manually against a reel flange during rewinding.

Even-Tension Winding Necessary

Rolls of film having convolutions with protruding edges are readily damaged when *forced* into shipping cases. The edges of the film may become bent or entirely broken, necessitating costly replacements. This is why exchanges prefer return of prints as they wind up in the projectors at the last showing. The lower sprocket of a projector insures smooth, even winding, provided that the take-up tension be properly adjusted. Many projectionists, nevertheless, dislike to use shipping reels in the lower magazines, but accidents seldom occur if the reel flanges are "spread" and the magazines are wide enough to accommodate such reels without scraping or binding.

Film should wind up in the projectors with sufficient tightness to prevent undue sidewise movement of the film layers during shipment. Lateral abrasions usually result from movements of the film layers during shipment, abetted by the uneven transit of the film through the gate.

Most commercial motor-driven rewinders have automatic shut-off switches to prevent violent slapping of the end of the film with damage to the leader. Many projectionists have devised excellent shut-off switches, some having seen more than 30 years of service with no signs of serious wear.

Dimensional Deformations of Film

Motion picture prints are subject to a number of dimensional defects.

"Curl" is the most common dimensional deformation of film. Some degree of curl is present in all film and is seldom deleterious to projection quality. Curl is due to dimensional differences between the emulsion layer and its support, or film base, and is caused by changes in the moisture-content of the emulsion and solvent-content of the support. Air constantly changes in relative humidity and temperature and the emulsion absorbs and releases moisture in accordance with these atmospheric changes. A flat piece of film held close to an ordinary light bulb will immediately curl with the emulsion side of the film concave. This is caused by loss of moisture from the gelatine emulsion.

The fact that the film base retains much of the curl imparted to it, even after all the emulsion has been removed, indicates that the structural strain of curl may become a more or less permanent characteristic of the film.

Curl is said to be "normal", or positive, when the emulsion side is concave; negative when the emulsion side is convex. Most film curl is positive. It will be noted that positive curl is induced in a flat piece of film no matter which side is presented to the warmth of a light bulb.

"Spoking" is the term applied to the wavy appearance of the convolutions of a loosely-wound roll of film having either a high degree of curl or a permanent "twist."

Edge-Weaving of Film

"Twist" is a weaving of the film produced when the edges are longer than the center section, caused by loose winding of freshly processed rolls of film under adverse atmospheric conditions. When fresh film is wound loosely with the emulsion side "in", and stored under excessively dry atmospheric conditions, the undulations alternate from one edge to the other. If the film be wound emulsion-side out and stored under the same conditions, the undulations are directly opposite each other.

When the edge-waves do not extend to the center of the film, but affect only one or both of the margins, twist is called "film-flute." Twist is usually

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a permanent deformation that produces a troublesome in-and-out-of-focus flutter on the screen.

"Buckle" is the opposite of *twist*. The edges of buckled film are shorter than the center section, giving the middle area of the film a characteristic humpy appearance. Buckle is due to temporarily shrunken side margins. Less severe buckling is caused by contact of the perforation margins of fresh film with excessively hot gate-runners and tension pads during projection.

The darker areas of the photo-emulsion do absorb heat. However, the interval of exposure to the arc beam is so brief that only the outer surface of the emulsion is raised to a high temperature, the base remaining relatively cool. In fact, the emulsion may even become blistered by irradiation without appreciably heating the base. Contact of the perforation margins with the hot gate rails and pads, on the other hand, heats *both* the emulsion and base in these areas by direct conduction, (cooled gates exempted).

The effectiveness of water-cooled gates is proven by the fact that the film winds up "cold" in such projectors even when the arc beam is strong enough to blister the emulsion.

Buckled film assumes a pin-cushioned form over the projector aperture. "Buckle" is called positive when the emulsion side is concave (the film bulging toward the lens) and negative when the emulsion side is convex (the film bulging toward the light source). "Normal" buckle is negative, the film bulging toward the lamp. Severely buckled film flops in-and-out of focus. *Increasing the gate tension does NOT materially reduce the fluttery effect of buckled film!*

Causes of Embossing

Embossing is a deformation produced by the effect of heat absorbed by the emulsion of the picture areas during exposure to the hot arc beam at the aperture. Each frame is exposed for two 1/96-second intervals when projected, with a 1/96-second blanking-out interval separating the exposures. Even this brief "flashing" is enough to expand the picture area so that the frames are raised above the general level of the film. Repeated projections increase the effect, until the frames can easily be seen to stand out like small cushions. Projection with extremely high-powered arcs may even *emboss* the photographic images, giving them the appearance of bas-relief carvings when examined by reflected light.

Embossing does not seriously impair the quality of the screen image, although when embossed film is spliced to unembossed film, the slight shift in the distance of the image from the lens when the splice passes by the aperture may require refocusing.

"Focus drift" and "flutter" are special effects common in 35-mm film projection. They may be caused by arc heat or other factors. Focus drift is generally regarded as a normal phenomenon which must be accepted by the projectionist, especially if lenses of short focal-length are used, in order to maintain a crisp focus on the screen at all times.

Because the convolutions, or individual turns, of film are smaller near the center of a roll than those near the outside, the amount of curl in the film is usually greater near the end of any reel. As the showing of a reel progresses, therefore, the slight degree of concavity of the film over the aperture gradually increases, moving the photographic image toward or away from the lens. Unless the focus be sharpened once or twice during the projection of a reel of film, the picture on the screen becomes increasingly blurred.

Flutter of the film over the aperture is often plainly visible on the screen, and is usually due to buckled film. There is no remedy for this condition.

The Arc Power Factor

Projection *via* powerful arcs causes a different kind of film flutter which becomes most pronounced during the second or third showing. The emulsion side of the film begins to expand when the intense light beam strikes it, and, accordingly, the film image moves *away* from the lens. The film begins to return to its normal position during the blanking period when the balancing blade of the shutter cuts off the light. *The expansion resumes during the next exposure.*

Now, this type of flutter is so rapid that it gives the effect of poor focus. It is impossible, however, to correct this condition with the focusing knob because the film moves back and forth *twice* during each "dwell" period when the intermittent sprocket is at rest.

At the very highest intensities, the film buckles and flops in and out of focus visibly. No projectionist can follow these irregular movements of the film to obtain a good focus. A light beam powerful enough to produce this very severe buckling may also destroy the print by blistering the emulsion. This phase will be considered subsequently.

[TO BE CONTINUED]

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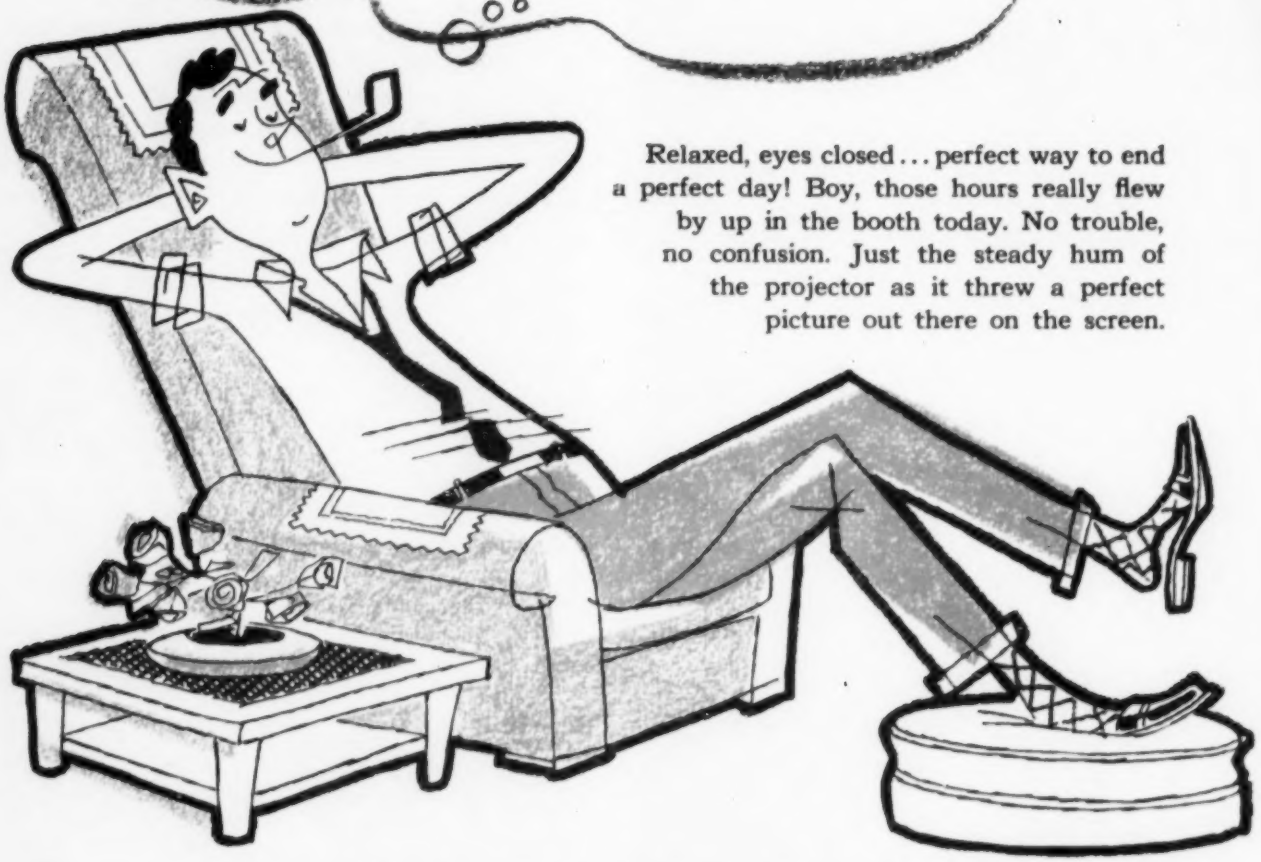
End of a Great Day!



Relaxed, eyes closed... perfect way to end a perfect day! Boy, those hours really flew by up in the booth today. No trouble, no confusion. Just the steady hum of the projector as it threw a perfect picture out there on the screen.

That's really not surprising though. There's *never* a rough day when you're working with a SIMPLEX! In all the many years up in a projection booth, you've always been able to count on a SIMPLEX to run smoothly and efficiently. Sure gives you a great feeling... gives you confidence and takes a lot of the pressure off.

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